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THE UNUSUAL WINDSTORM OF FEBRUARY 9, 1938, AT SAN FRANCISCO

By THOMAS R. REED

[Weather Bureau, San Francisco, Calif., March 1938]

From the 27th of January until the 14th of February 1938, northern California was visited by a series of rainstorms that followed one another in such rapid succession that there were scarcely any intermissions between them. In San Francisco precipitation of measurable amount (0.01 inch or more) fell on every day for 19 days—a new record for a continuous rainy period at that station. The previous longest period of consecutive rainy days was in February 1936, when rain of measurable amount fell on 15 consecutive days. Prior to that, the longest such period was 14 days, and occurred in the period January 25–February 7, 1884.

While nothing is known about the weather type associated with the rainy period of 1884, it is worth noting that the rains of February 1936 were associated with a weather type similar to that responsible for the rainy period of February 1938, when the all-time record for persistent rains in San Francisco was broken. It falls into Abercrombie's classification of Easterly Type LOWS, referred to by the writer in his "Weather Types of the Northeast Pacific Ocean" [1] but may be epitomized more conventionally by saying that during the period mentioned the polar front was found persistently south of its normal latitudes, while the tropical high-pressure belt had disappeared. Incidental to this displacement was a remarkably persistent "leakage" of Pc air southward over middle latitudes of the northeast Pacific Ocean in the vicinity of the 150th meridian, thus transforming the latter region into one of cyclogenesis in which depressions formed in rapid succession and traveled eastward, bringing central California regularly into the path of their wettest sectors.

The most casual reference to the synoptic charts of the period will confirm the foregoing description, but in further elucidation thereof selected pressure and temperature graphs for the epoch are supplied in figures 1 and 2. It will be noted (fig. 1) that atmospheric pressure was continuously above normal at Dutch Harbor and St. Paul, Alaska, and also almost continuously above normal at Edmonton, Alberta, while at stations in lower latitudes, represented by the graphs for Midway Island, etc., the pressure was prevailingly below normal. The southward and southwestward movement of air from the Arctic, consonant with this pressure regime, is illustrated by the temperature graphs (fig. 2) which show persistently subnormal temperatures at Juneau, Alaska, and at Edmonton, Alberta. The abnormal drift of Arctic air might be further exemplified by the record of free-air wind observations at Juneau, but the data available to the writer are so sparse as to be unsuitable for publication. However, such reports as came to hand during the period under review were consistent in showing a westward flow of air across the southeastern Alaska coast up to the highest altitudes reached by the balloons.

One of the depressions to form over lower latitudes at sea during this period is of especial interest because of the unusual strength of the winds which were associated with it at the time it moved onto the California coast. It was first indicated on the synoptic chart of February 6, near and northeast of Hawaii, but it exhibited no noteworthy features until the morning of the 8th when a well-developed vortex was apparent with center in approximately 31° N., and 130° W. Up to this time it had traveled almost due eastward, but in the next 24 hours its movement was toward the northeast, and its center appeared on the weather chart of the morning of February 9 near and southeast of the Farallon Islands, probably near the intersection of the 35th parallel and 135th meridian, at which time the central pressure was estimated to be 29.20 inches.

It was evident that the center would pass over central California during the day; whole gale warnings were displayed on the central California coast at 7 a. m. P. S. T., and special broadcasts of the approaching danger were issued to local radio stations and advices issued to the press. The center actually passed over or very near the San Francisco Bay region early in the afternoon. The behavior of the barometer during its passage is shown by the accompanying reproduction of the barograph trace (fig. 3) at the San Francisco station. Winds ranging in velocity from 38 miles per hour at San Francisco to 78 miles per hour at the Southeast Farallon were experienced. The wide range of velocities recorded at various points of observation within a relatively small area is worthy of note and is exhibited in the accompanying table.

Maximum wind velocities recorded in vicinity of San Francisco on Feb. 9, 1938

Station	Maximum velocity 5-minute period	Time	Extreme velocity (1 mile)	Time
Berkeley (Univ. of Calif.)	40 SE	11:35 a. m.	58 SE	11:35 a. m.
Grizzly Peak	72	1:00 p. m.	113	12:53 p. m.
Hamilton Field (U. S. Army)	36 SW	1:35 p. m.	45 SW	1:18 p. m.
Moffett Field (U. S. Army)	61 SW	12:30 p. m.	68 SW	12:36 p. m.
Oakland Airport (Weather Bureau)	35 SW	12:50 p. m.	67 SW	12:50 p. m.
Point Reyes (U. S. Lighthouse Bureau)	56	3:20 p. m.	64	3:22 p. m.
San Francisco (Weather Bureau)	38 SW	12:40 p. m.	47 SW	1:20 p. m.
San Francisco (Municipal Airport)	57 WSW	12:38 p. m.	78 WSW	12:47 p. m.
SE Farallon* (U. S. Navy)	78 W	(About noon)*		
Selby (Selby Hill)	60	1:50 p. m.	70	1:50 p. m.
Selby (Tunnel Hill)	58	1:45 p. m.	61	1:40 p. m.

* Observation obtained by buzzer type anemometer; no automatic record available.

[1] Reed, T. R., Monthly Weather Review, Vol. 60, pp. 246-252, Dec. 1932.

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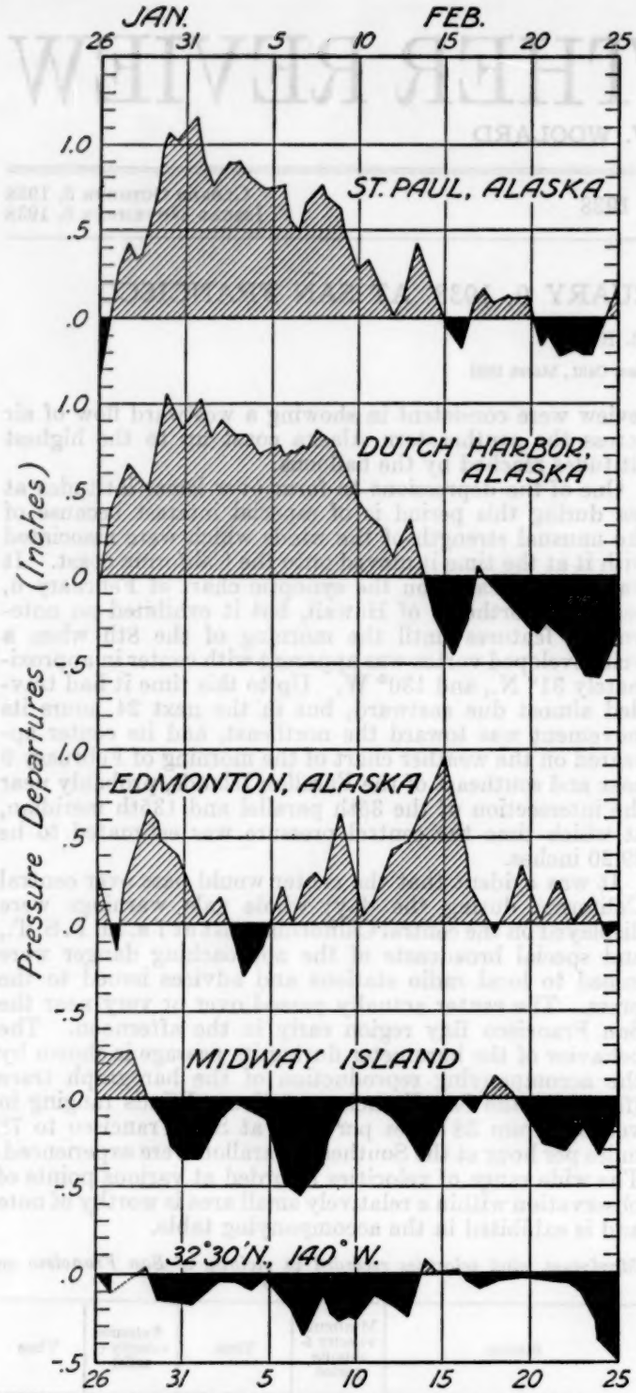

FIGURE 1.—Graphs showing departure from normal pressure during period of persistent rains in central California. Note the absence of the tropical high-pressure belt and of the low-pressure lane of northern latitudes.

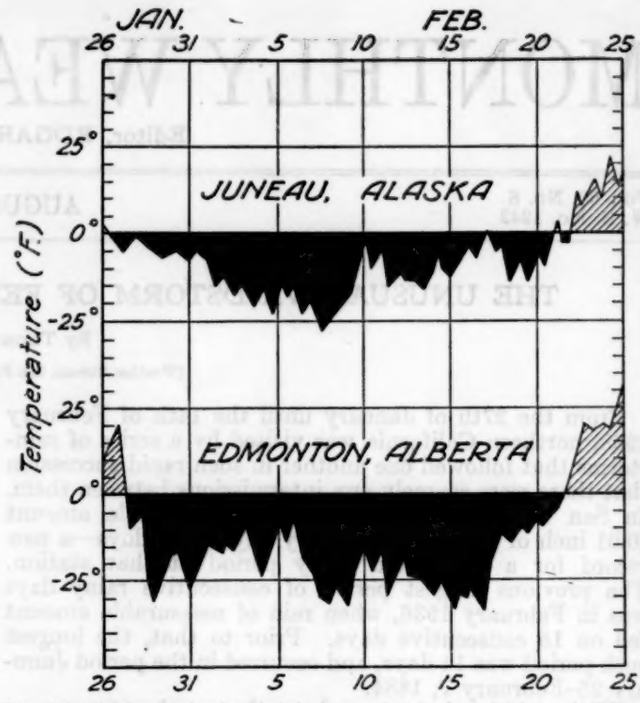

FIGURE 2.—Graphs showing departure from normal temperature during period of persistent rains in central California. Note the persistence of Pc air south of its normal latitudes.

In regard to the record at Oakland, J. A. Riley, official in charge, made the following comment:

The data were taken from the Dines anemograph. The Weather Bureau anemometer is also available but its record is not legible at time of highest wind. However, the buzzer attached to the anemometer was read several times during the storm and showed close agreement with the anemograph. Gusts on the anemograph occurred as follows: 12:50 p. m., 67 m. p. h.; 1:04 p. m., 64 m. p. h.; 1:20 p. m., 62 m. p. h.; all velocities uncorrected. The extreme velocity for 1 mile was 58 m. p. h., at 12:50 p. m.

E. P. Sullivan, meteorologist at the San Francisco Municipal Airport, made the following comment:

The highest gust recorded and the estimated average velocity for the highest 5-minute period (chosen after careful observation of the chart) are substituted for the extreme and maximum velocities usually cited, due to the fact that our anemograph is a Selsyn-motored pressure type instrument which records instantaneous velocities.

A shift in wind direction from SE to SSW occurred at about 11:50 a. m., at which time the velocity began climbing from an average of about 25 m. p. h. The first gust of 70 m. p. h. occurred at 12:30 p. m. Gusts over 70 m. p. h. continued through 1:10 p. m., after which the velocity decreased somewhat, but remained gusty with occasional peaks of 60 m. p. h. until around 4:30 p. m.

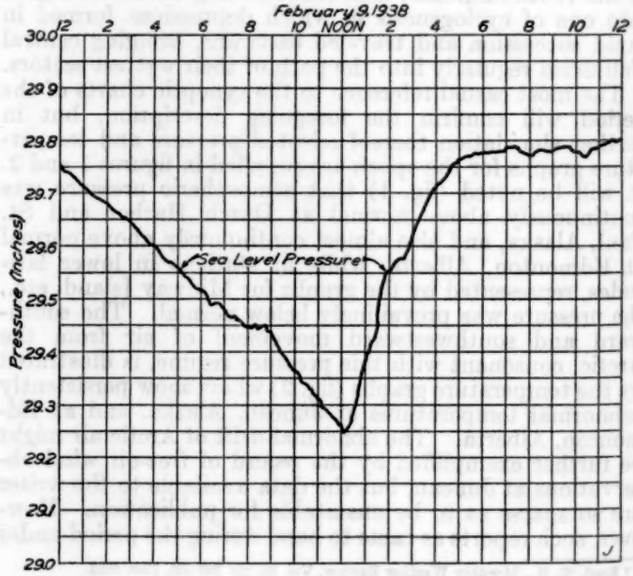

FIGURE 3.—Copy of barograph trace at San Francisco, Calif., February 9, 1938.

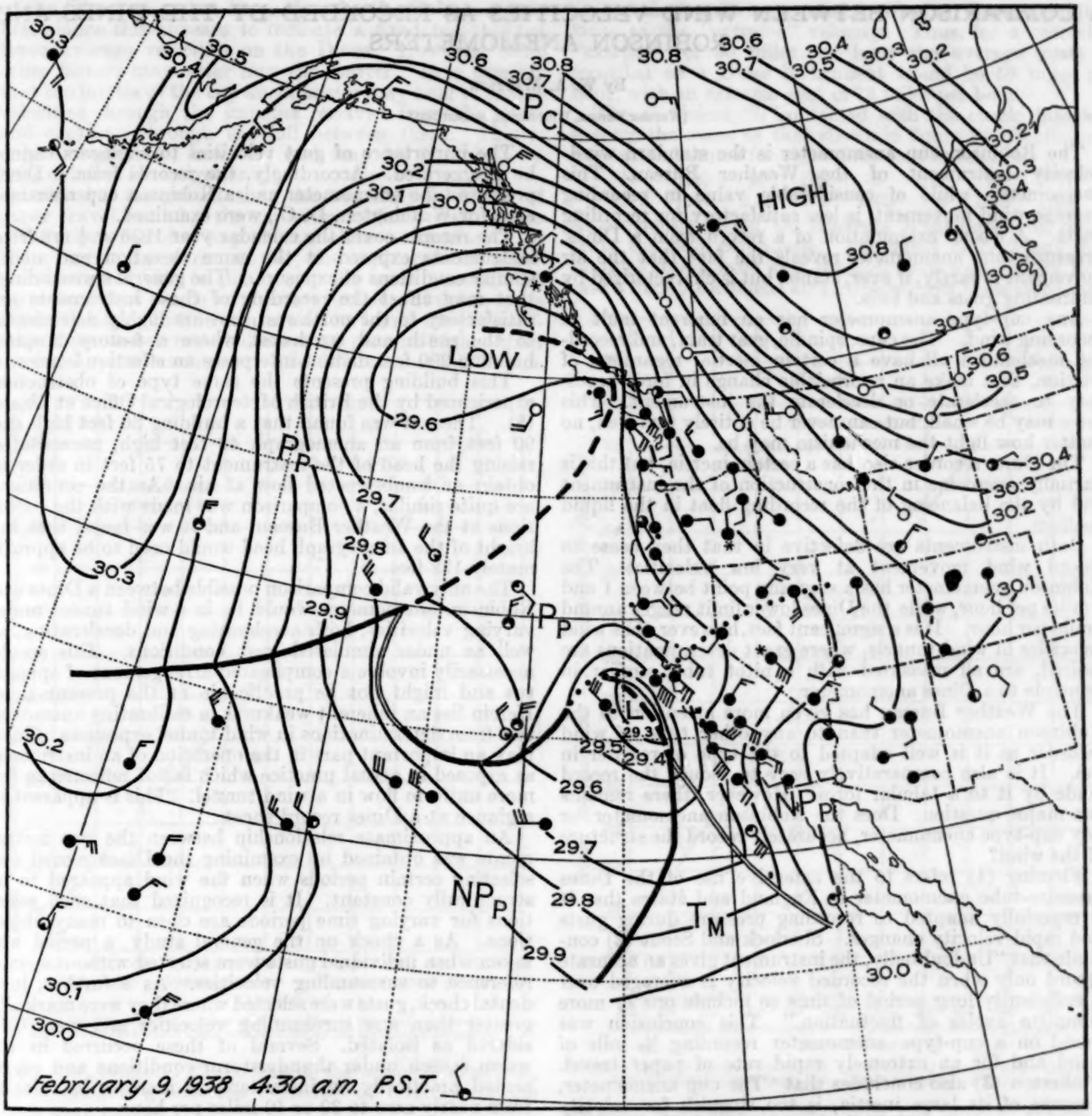

FIGURE 4.—Synoptic weather map for the morning of February 9, 1938. Analysis made by E. M. Vernon.

It might be mentioned that brief periods of power failure varying from a few seconds to about 1½ minutes occurred during the period of highest wind. The 1½ minute failure occurred just a few seconds after the 78 m. p. h. gust. During such periods the wind recorder is inoperative.

The most distant station in the above table is Point Reyes, situated on a coastal promontory 36 miles northwest of San Francisco. The station recording the highest extreme velocity, Grizzly Peak, is situated in the Berkeley Hills, 12 miles east-northeast of San Francisco, and at an elevation of 1,760 feet above sea level. The directions and distances of other observation points from the San Francisco city station are as follows: Berkeley, 11 miles ENE.; Hamilton Field, 20 miles N.; Moffett Field, 32 miles SE.; Oakland Airport, 11 miles E.; San Francisco Airport, 10 miles S.; Southeast Farallon, 31 miles WSW.; Selby, 21 miles NNE.

A COMPARISON BETWEEN WIND VELOCITIES AS RECORDED BY THE DINES AND ROBINSON ANEMOMETERS

By W. A. MATTICE

[Weather Bureau, Washington, August 1938]

The Robinson cup anemometer is the standard wind-velocity instrument of the Weather Bureau. This anemometer, while of considerable value in recording average wind movement, is less satisfactory for recording gusts. A casual examination of a record from a Dines' pressure tube anemometer reveals the fact that the air movement is rarely, if ever, stable, but is characterized by alternating gusts and lulls.

Any cup-type anemometer has an inherent fault in recording wind. The cups, spindle, gear train, and recording mechanism all have a certain inertia, regardless of friction, that make an appreciable change in force necessary to accelerate or decelerate the instrument. This force may be small, but can never be entirely removed, no matter how light the mechanism may be.

The Dines recorder also has a certain inertia, but this is partially overcome in the construction of the instrument and by the balancing of the recording float in the liquid medium.

Both instruments are defective in that they cease to record wind movement at very low velocities. The Robinson anemometer has a stopping point between 1 and 2 miles per hour, while the Dines lower limit ranges around 1 mile per hour. It is a significant fact, however, that wind velocities in wind tunnels, where exact determinations are desired, are all measured with a pitot tube, similar in principle to a Dines anemometer.

The Weather Bureau has given more attention to the Robinson anemometer than to any other type of wind recorder as it is well adapted to the type of register in use. It is also comparatively easy to reduce the record made by it to a tabular form. However, there remains one major question: Does the Robinson anemometer, or any cup-type anemometer, accurately record the structure of the wind?

Fleming (1) refers to the extensive use of the Dines pressure-tube anemometer in England and states that it is especially adapted to recording pressure during gusts and rapid velocity changes. Sherlock and Stout (2) conclude that "Undoubtedly, the instrument gives an accurate record only when the recorded velocity is averaged over a sufficiently long period of time to include one or more complete cycles of fluctuation." This conclusion was based on a cup-type anemometer recording ⅒ mile of wind and for an extremely rapid rate of paper travel. Pinkerton (3) also concludes that "The cup anemometer, because of its large inertia, is too sluggish for velocity measurements of wind gusts having accelerations greater than 2 m. p. h. per second." This author again uses an extremely rapid paper travel.

Marvin (4) has investigated numerous factors bearing on the behavior of the Robinson cup anemometer but treating more extensively of its mechanical details. It has been assumed by some investigators that cup anemometers will record gusts accurately if sufficiently rapid paper travel is used in recording the data from a ⅒ mile instrument. This assumption may be correct, but it is obviously impracticable to provide the necessarily rapid paper travel in ordinary practice. Therefore, these comparisons were made on the basis of the normal operations of the instruments.

The importance of gust velocities to engineers cannot be exaggerated. Accordingly, the records from a Dines pressure-tube anemometer and a Robinson cup anemometer, for Washington, D. C., were examined.

The records cover the calendar year 1936 and are from instruments exposed at the same elevation and under similar conditions of exposure. The general surroundings that may affect the recording of these instruments are satisfactory to the northwest, but are highly detrimental to the south and southwest where a 6-story hospital building 200 feet distant interposes an effective barrier.

This building presents the same type of obstruction experienced by the British Meteorological Office at Lizard (5). There it was found that a building 30 feet high and 90 feet from an anemograph 40 feet high, necessitated raising the head of the instrument to 75 feet in order to obtain an unobstructed flow of air. As the conditions are quite similar, a comparison was made with the conditions at the Weather Bureau, and it was found that the height of the anemograph head would need to be approximately 178 feet.

The only valid comparison possible between a Dines and Robinson anemometer would be in a wind tunnel under varying velocities, both accelerating and decelerating, as well as under simulated gust conditions. This would necessarily involve a complicated arrangement of apparatus and might not be practicable at the present time. Herein lies an inherent weakness in calibrating anemometers from determinations in wind tunnel exposures. Gusts play an important part in the operation of an instrument as exposed in actual practice which is not reflected in the more uniform flow in a wind tunnel. This is apparent in a glance at a Dines record sheet.

An approximate relationship between the two instruments was obtained by examining the Dines record and selecting certain periods when the wind appeared to be structurally constant. It is recognized that such selections for varying time periods are open to many objections. As a check on the general study, a period was taken when individual gusts were selected without special reference to surrounding velocities. As a further, incidental check, gusts were selected where they were markedly greater than any surrounding velocities and were considered as isolated. Several of these occurred in the warm season under thunderstorm conditions and represented practically an instantaneous increase in velocity from nearly zero to 30 or 40 miles per hour.

After securing the selected gusts, noting dates and times of occurrence, the corresponding velocities of the Robinson anemometer were obtained. In determining the fastest single mile on the Robinson record, certain variations in the time of occurrence were necessary due to lack of absolute synchronization of the two recorders. In selecting the fastest single mile, the time occasionally varied some few minutes from the time of the gust.

Another comparison between the two was attempted by averaging the records. For the periods covered in the Dines record, the average velocity was obtained by estimation. The Robinson average for the same period was obtained by measuring the individual miles and obtaining the mean. This resulted in an estimated velocity

of the Dines somewhat lower than for the Robinson. At first glance this appears to indicate a fixed bias toward lower average velocities on the Dines. However, some other factors may enter into the matter. It is possible that the inertia of the cup anemometer may tend to higher velocities through the impetus received from the gusts and continue through the lull between them. This is only a suggestion, however, and may be disproved by later detailed investigations.

It is also recognized that the relatively low rate of paper travel used by the recorders of both instruments effectively precludes any direct, close comparison. In Dines' original experiment (6), the rapid rate of paper travel enabled him to planimeter the areas beneath the curves and thus obtain an accurate estimate of the average wind velocity. In this comparison he found the pressure-tube anemometer recorded some 14 percent higher than the cup-type anemometer. The difference found in this

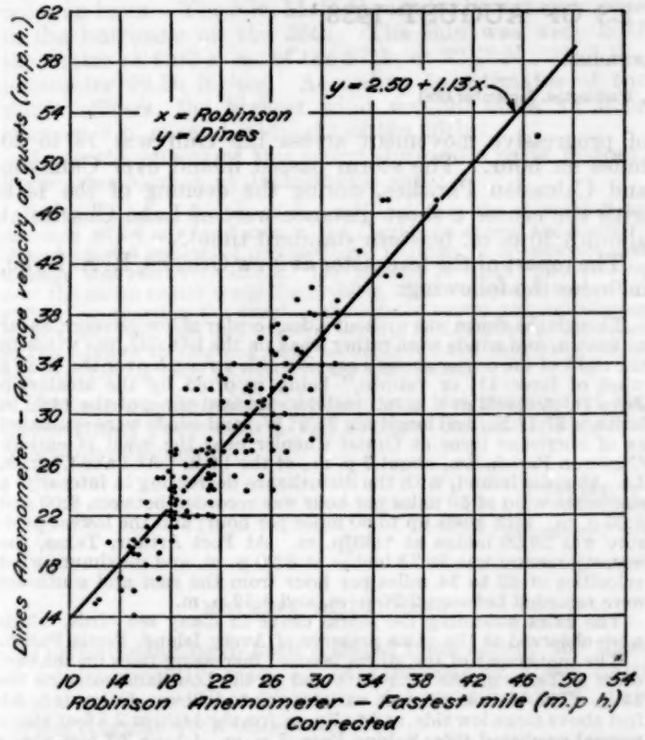

FIGURE 1.—Relation between average gust velocities as recorded on the Dines anemometer and the fastest single mile recorded by the Robinson anemometer.

study was, roughly, 22 percent in the opposite direction, clearly indicating that the estimates of velocity for the Dines were too low.

Figure 1 shows the relationship between the average velocities of the gusts for the periods and the corrected velocities of the fastest single mile of the Robinson instrument.

Figure 2 shows the relationship between the extreme gust recorded on the Dines anemometer and the corresponding corrected fastest single mile on the Robinson anemometer.

The coefficient "b" of the regression equations represents the "factor" to be applied to the Robinson record to reduce it to the Dines, either as average gusts, or extreme gust. Thus, in figure 1, the factor is 1.13 and in figure 2 it is 1.42. To reduce the Robinson record to a Dines record the following procedure can be used: The fastest single mile is recorded in Weather Bureau publications as the "extreme" velocity. Thus, for a corrected "extreme" of 50 miles per hour the average gusts as recorded on a Dines instrument would be 59 miles per hour, with an extreme gust of 73 miles per hour.

The coefficient "b" obtained with the check data was exactly the same as that shown in figure 2. Coefficients were also obtained for eight directions as follows:

N	NE	E	SE	S	SW	W	NW
1.72	1.07	2.30	.79	1.42	.85	1.09	1.34

As previously stated, the exposure to the northwest represents the best conditions. The rapid and violent fluctuations shown from east through southwest clearly indicate a highly turbulent air structure from these directions,

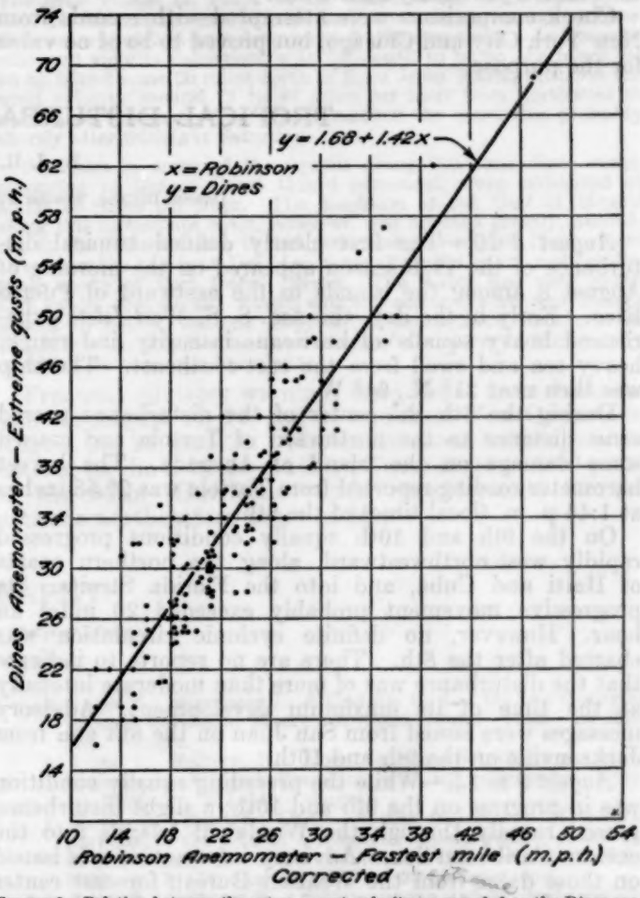

FIGURE 2.—Relation between the extreme gust velocity as recorded on the Dines anemometer and the fastest single mile recorded by the Robinson anemometer.

although the exposure itself does not indicate excessive interference, except for the large building previously noted.

Other variations in the comparisons show that varying conditions affect the factors but little. For example, based on gusts where the velocities show progressive increases, the factor is 1.36. An attempt to show the inertia of the cup anemometer brought out the following: The increase in velocity was noted on the Dines instrument and the percentage change in velocity for both the Dines and Robinson was recorded. When low starting-velocities were chosen between 3 and 15 miles per hour, the increase in the Dines record ranged from 100 to over 400 percent, with corresponding changes in the Robinson record from 91 to 112 percent.

Higher starting velocities, however, show conclusively that the Robinson responds more readily than at the lower ranges. For example, from 30 to 40 miles per hour, the Dines increased from 52 to 20 percent, but the Robinson from 89 to 33 percent.

In the case of the isolated gusts, previously discussed, due to the conditions mentioned in the above paragraph, the factor is 1.06. As the gust reaches its maximum and minimum in an extremely brief interval, the impulse given the cup anemometer must carry it through the corresponding minimum and cause it to register higher than it would normally.

The factor for average Dines velocities as compared to Robinson velocities was only 0.78, but was discarded for the reasons previously mentioned.

Check comparisons were attempted with records from New York City and Chicago, but proved to be of no value for the purpose.

No attempt will be made to draw conclusions from the data as it is realized that these are only approximations.

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(6) Dines, W. H. Anemometer Comparisons. Roy. Met. Soc. (London) Quar. Jour. XVIII, No. 83: July 1892.

TROPICAL DISTURBANCES OF AUGUST 1938 [1]

By I. R. TANNEHILL

[Marine Division, Weather Bureau, Washington, September 1938]

August 8–10.—The first clearly defined tropical disturbance of the 1938 season appeared on the morning of August 8 among the islands to the eastward of Puerto Rico. Early in the day, the Am. S. S. *West Isleta* experienced heavy squalls of hurricane intensity and rough, heavy sea and swell from the east-southeast. The ship was then near 21° N., 64° W.

During the 8th the center of the disturbance passed some distance to the northward of Tortola and caused some damage on the island of Anegada. The lowest barometer reading reported from Tortola was 29.58 inches at 1:44 p. m. (local time) of the 8th.

On the 9th and 10th squally conditions progressed rapidly west-northwestward, along the northern coasts of Haiti and Cuba, and into the Florida Straits. Its progressive movement probably exceeded 20 miles an hour. However, no definite cyclonic circulation was charted after the 8th. There are no reports to indicate that the disturbance was of more than moderate intensity at the time of its maximum development. Advisory messages were issued from San Juan on the 8th and from Jacksonville on the 9th and 10th.

August 9 to 14.—While the preceding squally condition was in progress on the 9th and 10th, a slight disturbance passed rapidly through the Windward Islands into the eastern Caribbean Sea. Advisory information was issued on those dates from the Weather Bureau forecast center at San Juan. It is not possible with reports at hand to trace the center of the disturbance with any assurance of accuracy beyond 14° N., 67° W., which was its approximate position at 7 p. m. (eastern standard time) of the 10th. However, its rapid progressive movement westward and the subsequent appearance of a rapidly moving tropical cyclone in the western Caribbean Sea on the 12th, indicates the probability that it continued to move west-northwestward on the 11th and is identical with the latter.

On the morning of August 12 a disturbance of marked intensity was centered near Grand Cayman Island, where shortly before 7 a. m. (eastern standard time) the wind reached a maximum velocity of 95 miles an hour from the east. Maintaining marked intensity, but with rather small diameter, the storm passed through the Yucatan Channel on the night of August 12–13, moved rapidly northwestward to the Central Gulf and thence north-northwestward into western Louisiana. Its average rate of progressive movement across the Gulf was 18 to 20 miles an hour. The storm passed inland over Cameron and Calcasieu Parishes, during the evening of the 14th with the center a short distance west of Lake Charles at about 8:30 p. m. (eastern standard time).

The report of the forecaster at New Orleans, R. A. Dyke, includes the following:

> Though the storm was without a deep center of low pressure, as far as known, and winds were rather weak on the left side, the winds to the right of the center showed considerable strength over the Gulf, a wind of force 11, or "storm," being reported by the steamship *John D. Archbold* at 9 a. m., eastern standard time, of the 14th, in latitude 27.1° N., and longitude 91.9° W.; and winds were estimated as of hurricane force at Grand Chenier near the coast of eastern Cameron Parish, La., about 7 p. m., of the 14th. At Lake Charles, La., 35 miles inland, with the disturbance decreasing in intensity, a southeast wind of 50 miles per hour was recorded between 8:00 and 8:30 p. m., with gusts up to 60 miles per hour; and the lowest pressure was 29.56 inches at 8:30 p. m. At Port Arthur, Texas, the lowest pressure was 29.73 inches at 8:20 p. m. and maximum wind velocities of 32 to 34 miles per hour from the east and southeast were recorded between 2:30 p. m. and 4:12 p. m.
>
> The gales attending the storm drove in many sea birds, which were observed at the game preserve of Avery Island, Iberia Parish.
>
> The movement of the storm favored increasing tides on the east coast of Texas on the 13th–14th and on the Louisiana coast on the 14th. The highest tides at various points follow: Galveston, 3.6 feet above mean low tide, at 6 to 7 p. m., on the 14th, or 2.8 feet above normal predicted tide; Sabine Pass, 7 p. m., 4.1, or 2.7 feet above normal predicted tide. Water was 4 to 5 feet above mean low tide on the coast of Cameron and Vermillion Parishes with lowlands flooded for depths of 1 to 4 feet. The storm caused a rise of about 2.5 feet in the Atchafalaya River at Morgan City, La., and tide slightly more than a foot above normal predicted tide at Grand Isle, La.
>
> Torrential rainfall preceding and attending the passage of the storm caused extensive overflow of crops and detours or interruption of highway traffic for a considerable distance inland, between twenty and forty miles east of the path of the storm center, especially in Jefferson Davis Parish and neighboring localities.
>
> Damage to buildings, wires, derricks, piers, and other property is estimated at $133,000; to crops, $110,000, principally to rice, but including considerable cotton damage from the heavy rains, and slight damage to sugarcane snapped off by the wind. Total losses are conservatively estimated at $243,000.
>
> At 10:30 a. m. of the 15th, about 12 hours after the storm center had passed, a small tornado occurred at Kinder, Allen Parish, 28 miles northeast of Lake Charles, destroying a house and prostrating two barns, fences, and some trees, with damage of $2,000 reported.

Advisory warnings were issued from Jacksonville on the 11th and 14th. Storm warnings were hoisted on the

[1] Tracks of the tropical disturbances of August are shown on chart X.

coast of Louisiana and the east coast of Texas early in the morning of the 14th and hurricane warnings were ordered from Morgan City, La., to Point Bolivar, Tex., at 2 p. m. (eastern standard time).

August 23–28.—Vessel reports showed disturbed conditions in the central Caribbean Sea on the morning of August 23 with some evidence of cyclonic circulation central about 250 miles southeast of Jamaica. This disturbance moved west-northwestward across northern Yucatan, with rapidly increasing intensity, and reached the Mexican Coast between Tampico and Brownsville on the morning of August 28.

On crossing Yucatan the storm was of full hurricane intensity. The Am. S. S. *Agwistar* was in the center on the morning of the 26th, while anchored 7 miles north of Progreso. Winds of hurricane force were experienced from 4 a. m. to 7 a. m. (local time) but with a dead calm from 5:15 to 6:00 a. m. Lowest pressure was 28.92 inches during the calm. The highest wind was estimated at 90 miles an hour. The Nic. M. S. *Sama* also became involved in the hurricane on the 26th. The ship was very near the center at 4:00 a. m. of the 27th, at 22½° N., 93½° W., barometer 29.26 inches. According to estimates of the ship's officers, the highest wind was 90 miles an hour between 8 p. m. and midnight of the 26th.

As to the effects of this storm during its early history, Forecaster Norton at Jacksonville says:

> We have had no reports of damage, and since the storm did not seriously affect any land area in the Caribbean except the sparsely settled coastal section of northeastern Yucatan, it is believed that damage was relatively small. The paucity of ships' observations near the storm center made the problem of the forecaster somewhat difficult in charting the exact center of the storm and calculating its intensity, but this lack of ships' reports is indicative of the value of the advices to shipping, and no reports have been received of any ship having been damaged in the Caribbean.

Concerning the winds aloft during the progress of the disturbance, Forecaster Dyke of New Orleans makes the following comment:

> Upper winds during the movement of the storm were from the east over the Middle and West Gulf States except for a brief interruption in the morning of the 26th, when upper winds, 10,000 feet and higher, were from the southeast over Texas. Upper winds at Tampico were from the northeast until the storm approached near enough to deflect them to the north and northwest. Under the prevailing flow of air no turning to the right was to be expected.

The following is taken from the report of the official in charge of the Weather Bureau office at Brownsville, regarding the passage of the storm into Mexico and the damage resulting there:

> Reports from Capt. Durst, Pan American Airways pilot, through Mr. Ronning their meteorologist, and from local fishermen who apparently were in the northern portion of the storm track, the center apparently went inland in the vicinity of Boca Jesus Maria, and the width of path of damage on the beach was about 75 to 80 miles. The little village La Pesca on the beach in the same latitude as Soto La Marina appears to have had winds strong enough to blow their palm-thatched huts down or badly damage them. In Brownsville and vicinity fishermen, who happened to be on the beach or on an island some 20 miles north of Boca Jesus Maria, estimate the wind velocity around 75 to 80 miles per hour from northwest to north into the east. The center reached the coast line probably shortly after midnight Saturday.
>
> Velocities in some of the squalls along this immediate coast, according to Brazos Coast Guard personnel, were estimated at about 45 miles per hour. The condition of the Gulf of Mexico along this immediate coast, however, was affected greatly, according to the Brazos Coast Guard personnel and reports from others at or near the beach at Del Mar, a resort on the beach a short distance south of Port Isabel, Texas. The water was very rough and swells occasionally swept entirely across Padre and Brazos islands in places, washing away a few inexpensive structures at Del Mar—the only damage as a result of the storm in the vicinity of which we have any knowledge.

Frequent advisory warnings were issued from Jacksonville on August 23, 24, and 25 and from New Orleans on August 26, 27, and 28. Northeast storm warnings were hoisted on the extreme southern Texas coast at 9:30 p. m. of the 26th. Hurricane winds were forecast for the extreme northeastern coast of Mexico.

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[RICHMOND T. ZOCH, *in Charge of Library*]

By AMY P. LESHER

RECENT ADDITIONS

The following have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies:

Agostini, Enrico de.
La Reale società geografica italiana e la sua opera dalla fondazione ad oggi (1867–1936). Roma. 1937. 149 p. plates, ports. 24½ cm. At head of title: Col. Enrico de Agostini, segretario della Reale società geografica italiana.

Astrophysica norvegica.
v. 1–2. 1934–1937. Oslo. 24 cm. ill., etc.
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SOLAR OBSERVATIONS

[Meteorological Research Division, EDGAR W. WOOLARD in charge]

SOLAR RADIATION OBSERVATIONS, AUGUST 1938

By IRVING F. HAND

Measurements of solar radiant energy received at the surface of the earth are made at eight stations maintained by the Weather Bureau, and at nine cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Washington, D. C., Madison, Wis., Lincoln, Nebr.) and at the Blue Hill Observatory of Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau stations at Washington and Madison.

The geographic coordinates of the stations, and descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data, obtained up to the end of 1936, will be found in the MONTHLY WEATHER REVIEW, December 1937, pages 415 to 441; further descriptions of instruments and methods are given in Weather Bureau Circular Q.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parenthesis). At Madison and Lincoln the observations are made with the Marvin pyrheliometer; at Washington and Blue Hill they are obtained with a recording thermopile, checked by observations with a Marvin pyrheliometer at Washington and with a Smithsonian silver disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 8 a. m. (75th meridian time) and at noon (local mean solar time).

During August 1938 normal incidence intensities averaged above normal at Madison and very close to normal at Lincoln. No measurements of this character were made at Washington.

Table 2 contains the average amounts of radiation received daily on a horizontal surface from both sun and sky during each week, their departures from normal and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the records of the Eppley pyrheliometer recording on either a microammeter or a potentiometer.

During August all stations showed an excess in the total solar and sky radiation with the exception of Fairbanks, Riverside, and Friday Harbor.

Polarization measurements made at Madison on 6 days give a mean of 56.2 percent with a maximum of 63 percent on the 12th. The mean value is close to the August normal, but the maximum value is appreciably lower than the normal for the month.

TABLE 1.—*Solar radiation intensities during August 1938*

[Gram-calories per minute per square centimeter of normal surface]

Date	Sun's zenith distance: 8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass: A. M.					P. M.				Local mean solar time
	e	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
MADISON, WIS.											
Aug. 1	14.10	------	0.64	0.79	1.00	1.24	------	------	------	------	16.20
Aug. 2	16.20	0.60	.72	.82	------	------	------	------	------	------	17.37
Aug. 4	12.24	.78	.92	1.05	1.23	1.44	------	------	------	------	11.81
Aug. 11	12.68	.89	------	1.14	1.28	1.46	------	------	------	------	11.38
Aug. 12	12.24	.94	1.00	1.15	1.31	1.48	------	------	------	------	11.38
Aug. 13	13.61	.74	.88	1.00	1.16	------	------	------	------	------	18.59
Aug. 17	12.24	------	------	1.06	1.24	1.39	------	------	------	------	13.61
Means	------	.79	.83	1.00	1.20	1.40	------	------	------	------	------
Departures	------	+.06	+.03	+.07	+.10	+.07	------	------	------	------	------
LINCOLN, NEBR.											
Aug. 2	15.65	------	------	------	------	1.24	1.03	------	------	------	13.13
Aug. 5	17.96	------	------	0.91	1.11	1.35	.99	------	------	------	16.20
Aug. 6	15.65	------	------	------	1.06	1.33	1.03	------	------	------	14.10
Aug. 9	16.20	------	------	------	------	1.37	1.12	------	------	------	15.11
Aug. 11	10.97	0.80	0.90	1.04	1.25	1.47	1.21	------	------	------	9.14
Aug. 12	9.14	.82	.92	1.09	1.26	1.50	1.18	------	------	------	10.21
Aug. 13	14.10	------	------	.94	1.16	1.36	------	------	------	------	14.10
Aug. 16	16.20	------	------	------	------	------	1.18	------	------	------	14.60
Aug. 17	16.79	.78	.90	1.03	1.24	1.45	------	------	------	------	14.10
Aug. 18	16.79	.60	------	------	1.01	------	------	------	------	------	19.89
Aug. 19	14.10	.70	.80	.99	1.18	1.37	.98	0.70	------	------	13.61
Aug. 22	17.37	.44	.55	.76	1.01	1.28	1.04	------	------	------	17.37
Aug. 23	13.13	------	------	.83	1.00	1.28	.89	.61	------	------	12.24
Aug. 24	12.24	.45	.58	.70	.92	------	.78	.58	------	------	16.20
Aug. 28	13.13	------	------	.79	1.02	1.38	------	------	------	------	15.65
Aug. 30	15.11	.54	.61	.77	1.00	------	.96	------	------	------	15.11
Means	------	.60	.75	.90	1.09	1.36	1.03	.63	------	------	------
Departures	------	−.02	−.03	−.01	.00	+.04	−.04	−.25	------	------	------

* Interpolated.

TABLE 2.—*Average daily totals of solar radiation (direct+diffuse) received on a horizontal surface*

Week beginning—	Washington	Madison	Lincoln	Chicago	New York	Fresno	Fairbanks	Twin Falls	La Jolla	New Orleans	Riverside	Blue Hill	San Juan	Friday Harbor	Ithaca	Newport
	Gram-calories per square centimeter															
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
July 30	468	509	589	505	439	697	337	622	494	393	524	562	664	621	464	559
Aug. 6	417	479	517	449	407	684	348	594	512	422	501	448	584	556	478	461
Aug. 13	520	491	498	498	462	675	298	609	576	557	480	587	665	478	420	480
Aug. 20	516	489	489	514	508	600	206	536	547	574	499	530	538	510	488	597
Aug. 27	430	469	416	------	454	573	201	447	482	513	452	496	612	369	426	502
	Departures of daily totals from normals															
July 30	−5	+38	+67	+108	+8	+30	−18	+71	−58	−67	−52	+24	+110	+67	+14	------
Aug. 6	−21	+21	+15	+52	+73	+44	+33	+43	−8	−25	−36	−37	+73	+20	+43	------
Aug. 13	+77	+46	+4	+93	+86	+47	+4	+110	+105	+129	−55	+60	+148	−50	−16	------
Aug. 20	+103	+45	0	+103	+176	+5	−67	+6	+24	+142	−17	+17	0	+14	+72	------
Aug. 27	+12	+61	−31	------	+98	−4	−38	−39	+26	+68	−32	+81	+65	−67	+52	------
	Accumulated departures since Jan. 1															
	−9,524	−868	−861	+6,587	+2,121	−924	+4,207	−6,139	−3,017	+5,012	−5,642	−2,882	+11,233	+7,938	+1,841	------

PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR AUGUST 1938

[Dependent alone on observations at Zurich, Switzerland]

[Data furnished through the courtesy of Prof. W. Brunner]

August 1938	Relative numbers	August 1938	Relative numbers	August 1938	Relative numbers
1	*add* 144	11	*ad* 173	21	*a* 65
2	121	12	132	22	72
3	*EWcc* 121	13		23	*Macc* 94
4	d 153	14	*bd* 107	24	86
5	*dd* 132	15	102	25	*Ecc* 113
6	*a* 133	16	*Eac* 119	26	103
7	*aaa* 135	17	106	27	*d* 91
8	*d* 150	18	100	28	*a* 94
9	158	19	104	29	*d* 114
10	*ab* 161	20	76	30	105
				31	

Mean, 29 days = 116.0

August 4^h at^m 8^h 34^m to 8^h 45^m U. T. Middle large bright chromospheric eruption.

August 4^h at^m 9^h 00^m to 9^h 25^m U. T. Middle large bright chromospheric eruption.

August 14^h at^m 13^h 27^m to 14^h 10^m U. T. Middle large bright chromospheric eruption.

a = Passage of an average-sized group through the central meridian.
b = Passage of a large group or spot through the central meridian.
c = New formation of a group developing into a middle-sized or large center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central circle zone.
d = Entrance of a large or average-sized center of activity on the east limb.

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, U. S. Navy (Ret.), Superintendent, U. S. Naval Observatory. Data furnished by the U. S. Naval Observatory in cooperation with Harvard and Mount Wilson Observatories. The difference in longitude is measured from the central meridian, positive west. The north latitude is positive. Areas are corrected for foreshortening and are expressed in millionths of the sun's visible hemisphere. The total area for each day includes spots and groups]

Date	Eastern standard time	Mt. Wilson group No.	Heliographic: Diff. in longitude	Heliographic: Longitude	Heliographic: Latitude	Area: Spot or group	Area: Total for each day	Spot count	Observatory
1938	h m		°	°	°				
Aug. 1	10 54	6029	−80.0	86.9	−7.0	291		2	U. S. Naval
		6030	−79.0	87.9	−17.0	388		4	
		6028	−79.0	87.9	+13.0	291		2	
		6027	−74.5	92.4	+17.0	6		2	
		6025	−67.0	99.9	−1.0	73		1	
		6024	−60.5	106.4	−10.5	73		1	
		6022	+30.0	196.9	+20.0	6		3	
		6017	+33.0	199.9	−6.0	388		32	
		6016	+41.0	207.9	−21.0	388		15	
		6023	+49.5	216.4	+6.0	12		2	
		6014	+59.5	226.4	−7.5	61		2	
		6012	+81.0	247.9	+4.0	6	1,983	2	
Aug. 2	13 6	6029	−66.0	86.4	−7.0	291		2	Do.
		6028	−65.0	87.4	+13.0	48		4	
		6030	−63.0	89.4	−16.0	218		3	
		6027	−62.0	90.4	+17.5	291		8	
		6025	−52.0	100.4	−1.0	61		1	
		6024	−47.5	104.9	−11.0	73		1	
		6017	+49.0	201.4	−7.0	388		32	
		6016	+59.0	211.4	−21.0	242		6	
		6014	+72.0	224.4	−8.0	6	1,618	2	
Aug. 3	14 30	6028	−53.0	85.5	+12.5	388		18	Do.
		6029	−51.5	87.0	−7.0	242		2	
		6030	−51.0	87.5	−16.0	206		2	
		6027	−49.0	89.5	+17.5	24		6	
		6025	−37.5	101.0	−1.0	48		2	
		6033	−37.0	101.5	−17.0	97		10	
		6024	−32.0	106.5	−11.0	61		2	
		6031	+50.0	188.5	+7.0	48		3	
		6017	+64.0	202.5	−7.0	388		18	
		6016	+73.0	211.5	−21.0	388	1,890	5	
Aug. 4	10 51	6037	−85.0	42.2	−13.0	97		3	Do.
		6037	−82.0	45.2	−19.0	194		2	
		6036	−73.0	54.2	−26.0	388		3	
		6029	−40.0	87.2	−7.5	291		3	
		6030	−39.0	88.2	−16.0	194		4	
		6028	−39.0	88.2	+11.0	315		18	
		6027	−33.0	94.2	+18.0	6		3	
		6033	−26.0	101.2	−17.0	61		12	

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mt. Wilson group No.	Heliographic: Diff. in longitude	Heliographic: Longitude	Heliographic: Latitude	Area: Spot or group	Area: Total for each day	Spot count	Observatory
1938	h m		°	°	°				
Aug. 4	10 51	6025	−24.0	103.2	−2.0	61		2	U. S. Naval.
		6024	−20.5	106.7	−11.0	73		3	
		6035	−15.0	112.2	+18.0	24		2	
		6034	+12.0	139.2	+18.0	12		3	
		6032	+39.0	166.2	+10.5	24		6	
		6031	+63.0	190.2	+7.5	291		15	
		6017	+75.0	202.2	−8.5	145		6	
		6016	+88.0	215.2	−21.0	97	2,273	1	
Aug. 5	14 40	6039	−80.0	31.9	+3.0	194		1	Do.
		6038	−77.0	34.9	+23.0	121		1	
		6037	−69.0	42.9	−13.0	485		11	
		6037	−65.0	46.9	−19.0	242		1	
		6036	−59.0	52.9	−26.5	388		10	
		6029	−26.0	85.9	−7.0	267		1	
		6030	−25.0	86.9	−15.0	194		1	
		6028	−23.0	88.9	+11.0	242		8	
		6033	−10.0	101.9	−17.0	97		9	
		6025	−8.0	103.9	−2.0	48		1	
		6024	−6.0	105.9	−11.0	61		1	
		6035	+1.0	112.9	+19.0	85		9	
		6031	+79.0	190.9	+8.0	291	2,715	6	
Aug. 6	12 1	6039	−68.0	32.2	+3.0	194		1	Do.
		6038	−65.0	35.2	+23.0	121		2	
		6037	−57.0	43.2	−13.0	727		22	
		6037	−53.0	47.2	−19.0	339		3	
		6036	−49.0	51.2	−26.5	388		7	
		6029	−13.0	87.2	−7.0	267		1	
		6030	−12.0	88.2	−15.0	194		2	
		6030	−9.0	91.2	−17.0	48		6	
		6028	−10.0	90.2	+11.0	242		5	
		6033	+3.0	103.2	−17.0	73		6	
		6025	+6.0	106.2	−2.0	24		2	
		6024	+7.5	107.7	−11.0	61		2	
		6035	+11.0	111.2	+19.0	24		1	
		6031	+80.0	189.2	+8.0	97	2,799	1	
Aug. 7	8 58	6039	−56.0	32.6	+3.0	194		1	Mt. Wilson.
		6038	−52.0	36.6	+23.0	73		1	
		6037	−46.0	42.6	−13.0	582		22	
		6037	−41.5	47.1	−19.0	291			
		6036	−38.0	50.6	−27.5	388		7	
		6029	−1.0	87.6	−7.0	267		6	
		6030	−0.5	88.1	−15.0	218		11	
		6030	+3.0	91.6	−17.0	61			
		6028	+3.0	91.6	+11.0	206		7	
		6033	+13.0	101.6	−17.0	73		6	
		6025	+18.0	106.6	−2.5	24		1	
		6024	+19.5	108.1	−11.0	73		2	
		6035	+21.0	109.6	+19.0	16	2,466	1	
Aug. 8	11 4	6042	−79.0	355.2	−24.0	873		9	U. S. Naval.
		6039	−42.0	32.2	+3.0	194		2	
		6038	−39.0	35.2	+22.5	97		2	
		6037	−32.0	42.2	−13.5	582		36	
		6037	−28.0	46.2	−19.0	291		8	
		6036	−25.0	49.2	−27.5	388		13	
		6029	+12.0	86.2	−7.0	242		1	
		6029	+14.0	88.2	−14.5	194		1	
		6030	+19.0	93.2	−17.0	24		5	
		6028	+15.0	89.2	+11.0	242		16	
		6041	+19.0	93.2	+13.0	6		9	
		6033	+28.0	102.2	−16.5	97		16	
		6024	+32.0	106.2	−11.0	61		2	
		6025	+32.0	106.2	−3.0	36	3,327	1	
Aug. 9	11 2	6044	−74.0	347.0	+7.0	6		2	Do.
		6042	−63.0	358.0	−25.0	970		15	
		6039	−29.0	32.0	+3.0	145		2	
		6038	−25.5	35.5	+22.5	73		3	
		6037	−18.5	42.5	−14.0	533		28	
		6037	−13.5	47.5	−19.0	291		15	
		6036	−12.0	49.0	−28.0	291		15	
		6029	+27.0	88.0	−7.0	200		2	
		6028	+27.0	88.0	+11.0	339		15	
		6030	+29.0	90.0	−15.0	194		1	
		6030	+32.0	93.0	−17.0	12		5	
		6041	+32.0	93.0	+13.0	97		13	
		6033	+45.0	106.0	−16.5	48		9	
		6025	+45.0	106.0	−3.0	24		4	
		6024	+47.0	108.0	−11.5	61	3,284	2	
Aug. 10	11 3	6045	−80.0	327.8	−22.0	194		1	Do.
		6044	−61.5	346.3	+7.0	24		1	
		6042	−50.0	357.8	−25.0	824		20	
		6039	−15.0	32.8	+3.0	97		4	
		6038	−13.0	34.8	+22.5	61		2	
		6037	−5.0	42.8	−14.0	582		20	
		6037	−0.5	47.3	−19.0	291		5	
		6036	+1.5	49.3	−28.0	242		8	
		6029	+40.0	87.8	−7.0	242		4	
		6028	+40.0	87.8	+11.0	291		11	
		6030	+41.0	88.8	−15.0	194		2	
		6041	+46.0	93.8	+14.0	48		12	
		6033	+58.0	105.8	−16.0	16		2	
		6024	+61.0	108.8	−11.0	36	3,142	1	

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mt. Wilson group No.	Heliographic: Diff. in longitude	Heliographic: Longitude	Heliographic: Latitude	Area: Spot or group	Area: Total for each day	Spot count	Observatory
1938	h m		°	°	°				
Aug. 11	13 3	6045	−65.0	328.5	−21.0	194	.....	1	U. S. Naval.
		6044	−47.0	346.5	+7.0	12	.....	1	
		6042	−35.0	358.5	−25.0	679	.....	28	
		6039	0.0	33.5	+3.0	97	.....	2	
		6038	+1.0	34.5	+22.0	36	.....	5	
		6037	+9.0	42.5	−14.0	533	.....	25	
		6037	+13.5	47.0	−19.0	291	.....	12	
		6036	+15.0	48.5	−28.0	145	.....	13	
		6046	+40.5	74.0	+13.0	24	.....	2	
		6029	+53.0	86.5	−7.0	218	.....	1	
		6030	+53.0	86.5	−14.0	194	.....	1	
		6028	+56.0	89.5	+12.0	267	.....	11	
		6041	+60.0	93.5	+14.0	73	.....	9	
		6033	+70.0	103.5	−15.0	12	.....	1	
		6024	+75.0	108.5	−12.0	36	2,811	1	
Aug. 12	11 15	6045	−82.0	329.3	−22.0	194	.....	3	Do.
		6044	−34.0	347.3	+7.5	12	.....	1	
		6042	−23.0	358.3	−25.0	485	.....	14	
		6039	+13.0	34.3	+3.0	121	.....	2	
		6038	+13.0	34.3	+22.5	24	.....	4	
		6037	+22.0	43.3	−14.0	388	.....	11	
		6037	+26.5	47.8	−19.0	291	.....	10	
		6036	+25.0	46.3	−28.5	61	.....	4	
		6046	+51.0	72.3	+14.0	12	.....	1	
		6029	+67.0	88.3	−7.0	194	.....	3	
		6030	+68.0	89.3	−14.5	194	.....	1	
		6028	+69.0	90.3	+12.0	145	.....	2	
		6041	+75.0	96.3	+13.0	48	2,169	4	
Aug. 13	10 50	6045	−40.0	328.3	−22.0	194	.....	2	Do.
		6049	−32.0	336.3	−18.0	24	.....	5	
		6044	−22.0	346.3	+8.0	12	.....	1	
		6042	−11.0	357.3	−25.0	485	.....	22	
		6039	+25.0	33.3	+4.0	73	.....	2	
		6050	+26.0	34.3	−24.5	6	.....	1	
		6038	+26.0	34.3	+23.0	24	.....	2	
		6037	+33.0	41.3	−14.0	388	.....	15	
		6037	+38.5	46.8	−19.0	242	.....	8	
		6036	+37.0	45.3	−28.0	48	.....	3	
		6046	+66.0	74.3	+14.0	12	.....	2	
		6029	+80.0	88.3	−7.0	206	.....	1	
		6030	+81.0	89.3	−14.5	145	.....	1	
		6028	+84.0	92.3	+12.0	145	2,004	2	
Aug. 14	12 32	6054	−82.0	272.1	+10.5	36	.....	1	Do.
		6053	−46.0	308.1	+9.0	6	.....	1	
		6045	−27.0	327.1	−21.0	194	.....	3	
		6042	+2.0	356.1	−25.0	485	.....	28	
		6052	+19.0	13.1	−11.0	6	.....	1	
		6039	+39.0	33.1	+4.0	73	.....	1	
		6038	+39.0	33.1	+23.0	12	.....	4	
		6037	+48.0	42.1	−14.5	339	.....	8	
		6037	+52.0	46.1	−19.0	242	.....	1	
		6036	+51.0	45.1	−28.0	12	1,405	1	
Aug. 15	11 9	6059	−82.0	259.6	+2.0	97	.....	1	Do.
		6058	−74.0	267.6	−18.0	24	.....	1	
		6054	−69.0	272.6	+10.5	145	.....	5	
		6057	−49.5	292.1	+18.0	36	.....	3	
		6056	−41.0	300.6	+18.0	24	.....	2	
		6053	−33.0	308.6	+9.5	6	.....	2	
		6045	−14.0	327.6	−21.0	218	.....	6	
		6055	+9.0	350.6	+11.0	24	.....	5	
		6042	+14.0	355.6	−26.0	485	.....	25	
		6039	+51.0	32.6	+4.0	73	.....	1	
		6037	+61.0	42.6	−14.0	339	.....	5	
		6037	+66.0	47.6	−19.0	218	.....	1	
		6036	+65.0	46.6	−29.0	12	1,701	1	
Aug. 16	14 2	6059	−67.0	259.9	+2.0	73	.....	1	Do.
		6058	−62.0	264.9	−19.0	24	.....	4	
		6054	−55.0	271.9	+10.5	97	.....	13	
		6061	−55.0	271.9	+16.0	36	.....	6	
		6057	−34.0	292.9	+18.0	12	.....	2	
		6056	−27.0	299.9	+18.0	97	.....	13	
		6060	−30.5	296.4	+8.0	6	.....	1	
		6045	+1.0	327.9	−21.0	194	.....	4	
		6042	+27.0	353.9	−27.0	291	.....	17	
		6039	+67.0	33.9	+4.0	73	.....	1	
		6037	+77.0	43.9	−13.0	291	.....	1	
		6037	+80.5	47.4	−19.0	194	1,388	1	
Aug. 17	11 52	6059	−53.0	261.8	+2.0	48	.....	3	Do.
		6058	−49.0	265.8	−19.0	24	.....	3	
		6061	−43.0	271.8	+15.5	36	.....	9	
		6054	−41.0	273.8	+10.5	73	.....	10	
		6056	−14.0	300.8	+17.0	48	.....	8	
		6062	+4.0	318.8	+7.0	36	.....	6	
		6045	+12.0	326.8	−21.0	97	.....	5	
		6042	+40.0	354.8	−27.0	194	.....	12	
		6039	+79.0	33.8	+4.0	36	592	2	

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mt. Wilson group No.	Heliographic: Diff. in longitude	Heliographic: Longitude	Heliographic: Latitude	Area: Spot or group	Area: Total for each day	Spot count	Observatory
1938	h m		°	°	°				
Aug. 18	11 25	6059	−40.0	261.9	+2.0	97	.....	5	U. S. Naval.
		6061	−29.0	272.9	+16.0	61	.....	10	
		6054	−28.5	273.4	+11.0	97	.....	38	
		6065	−9.0	292.9	+17.0	36	.....	11	
		6056	−3.0	298.9	+19.0	61	.....	7	
		6053	+6.0	307.9	+10.0	73	.....	16	
		6063	+13.0	314.9	−11.0	6	.....	6	
		6045	+25.0	326.9	−21.0	194	.....	2	
		6064	+27.0	328.9	+25.0	6	.....	4	
		6042	+52.0	353.9	−27.0	121	752	10	
Aug. 19	10 59	6067	−40.0	248.9	−25.5	24	.....	4	Do.
		6059	−27.0	261.9	+2.0	97	.....	1	
		6054	−16.0	272.9	+11.0	121	.....	22	
		6061	−15.0	273.9	+16.0	61	.....	11	
		6065	−4.0	284.9	+18.0	36	.....	4	
		6066	−3.5	285.4	+36.0	6	.....	2	
		6056	+10.0	298.9	+19.0	6	.....	2	
		6053	+20.0	308.9	+10.5	61	.....	11	
		6045	+38.5	327.4	−21.0	194	.....	2	
		6064	+41.0	329.9	+25.0	36	.....	5	
		6042	+65.0	353.9	−27.0	109	751	7	
Aug. 20	11 0	6071	−80.0	195.6	+8.5	24	.....	1	Do.
		6070	−70.0	205.6	−24.0	24	.....	1	
		•	−50.0	225.6	+6.0	6	.....	1	
		6059	−13.0	262.6	+2.0	109	.....	1	
		6054	−4.0	271.6	+10.0	48	.....	5	
		6061	+1.0	276.6	+16.0	36	.....	2	
		6063	+15.0	290.6	−11.0	6	.....	6	
		6068	+19.0	294.6	+17.0	61	.....	5	
		6053	+34.5	310.1	+10.0	12	.....	3	
		6045	+51.0	326.6	−22.0	194	520	3	
Aug. 21	11 55	6072	−86.0	175.9	+7.0	145	.....	1	Mt. Wilson.
		6071	−66.0	195.9	+9.0	16	.....	3	
		6070	−57.0	204.9	−23.0	24	.....	3	
		6067	−10.0	251.9	−24.0	24	.....	3	
		6059	+1.0	262.9	+2.0	73	.....	1	
		6054	+12.0	273.9	+11.0	73	.....	8	
		6065	+22.0	283.9	+19.0	85	.....	8	
		6068	+33.0	294.9	+19.0	73	.....	9	
		6045	+65.0	326.9	−22.0	121	634	2	
Aug. 22	11 55	6072	−71.0	177.7	+7.0	12	.....	2	Do.
		6071	−51.0	197.7	+9.5	16	.....	5	
		6074	−13.0	235.7	−19.0	24	.....	4	
		6067	0.0	248.7	−25.0	48	.....	9	
		6059	+13.0	261.7	+2.0	97	.....	1	
		6054	+28.0	276.7	+11.0	73	.....	13	
		6065	+37.5	286.2	+18.0	36	.....	6	
		6068	+47.0	295.7	+18.0	61	.....	7	
		6073	+58.0	306.7	−9.0	12	.....	4	
		6045	+79.0	327.7	−22.0	121	500	2	
Aug. 23	11 4	6072	−58.0	178.0	+6.5	36	.....	2	U. S. Naval.
		6071	−39.0	197.0	+9.0	24	.....	2	
		6070	−31.0	205.0	−23.0	6	.....	2	
		6074	0.0	236.0	−18.0	170	.....	17	
		6067	+13.0	249.0	−24.0	61	.....	10	
		6059	+27.0	263.0	+2.0	97	.....	2	
		6054	+41.0	277.0	+11.0	97	.....	10	
		6065	+48.0	284.0	+19.0	24	.....	2	
		6068	+60.0	296.0	+19.0	36	551	5	
Aug. 24	11 3	6078	−85.0	137.8	+27.0	6	.....	2	Do.
		6072	−44.0	178.8	+6.5	12	.....	1	
		6076	−25.5	197.3	+15.0	24	.....	4	
		6071	−25.5	197.3	+9.0	12	.....	1	
		6070	−17.0	205.8	−22.0	24	.....	6	
		6074	+13.5	236.3	−19.0	194	.....	30	
		6067	+28.0	250.8	−25.0	24	.....	8	
		6059	+40.0	262.8	+2.0	97	.....	1	
		6054	+55.0	277.8	+9.5	73	.....	6	
		6068	+71.0	293.8	+18.0	24	490	1	
Aug. 25	11 14	6082	−75.0	134.5	−16.0	12	.....	4	Do.
		6078	−90.0	139.5	+27.0	6	.....	3	
		6077	−43.0	166.5	+12.0	97	.....	8	
		6072	−30.0	179.5	+7.0	12	.....	1	
		6076	−12.0	197.5	+16.0	12	.....	1	
		6071	−11.5	198.0	+10.0	24	.....	1	
		6070	−1.5	208.0	−21.0	36	.....	1	
		6074	+27.0	236.5	−19.0	291	.....	24	
		6059	+52.0	261.5	+2.0	48	.....	2	
		6054	+70.0	279.5	+9.5	48	.....	3	
		6068	+85.0	294.5	+18.0	6	592	2	
Aug. 26	11 17	6082	−60.0	136.2	−17.0	121	.....	6	Do.
		6078	−59.0	137.2	+27.0	145	.....	13	
		6077	−29.0	167.2	+12.0	121	.....	19	
		6072	−16.0	180.2	+7.0	6	.....	1	

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mt. Wilson group No.	Heliographic			Area		Spot count	Observatory
			Diff. in longitude	Longitude	Latitude	Spot or group	Total for each day		
1938	h m		°	°	°				
Aug. 26...	11 17	6071	+2.0	198.2	+9.5	12	.....	1	U. S. Naval.
		6081	+4.0	200.2	−27.0	6	.....	3	
		6070	+12.0	208.2	−22.0	12	.....	2	
		6080	+23.0	219.2	−20.0	12	.....	3	
		6079	+23.0	219.2	+24.0	12	.....	4	
		6074	+42.0	238.2	−19.5	194	.....	33	
		6059	+66.0	262.2	+2.0	12	.....	2	
		6054	+85.0	281.2	+9.5	12	665	1	
Aug. 27...	10 59	6084	−82.0	101.2	+13.0	121	.....	5	Do.
		6082	−48.5	134.7	−18.0	36	.....	4	
		6078	−47.0	136.2	+27.5	97	.....	12	
		6077	−16.0	167.2	+12.0	121	.....	17	
		6081	+12.0	195.2	−26.0	6	.....	1	
		6071	+14.0	197.2	+10.0	6	.....	1	
		6070	+25.0	208.2	−21.0	16	.....	2	
		6074	+54.5	237.7	−18.0	242	645	18	
Aug. 28...	11 6	6090	−88.0	81.9	−14.0	242	.....	2	Do.
		6089	−85.0	84.9	−6.0	6	.....	1	
		6088	−82.0	87.9	+14.0	194	.....	1	
		6084	−74.0	95.9	+13.0	485	.....	14	
		6087	−66.0	103.9	−22.5	12	.....	2	
		6086	−45.0	124.9	−15.0	12	.....	3	
		6082	−33.0	131.9	−20.5	6	.....	2	
		6078	−35.0	134.9	+28.0	145	.....	11	
		6077	−3.0	166.9	+13.0	145	.....	14	
		6070	+38.0	207.9	−21.0	12	.....	3	
		6074	+69.0	238.9	−19.0	291	1,550	10	
Aug. 29...	11 3	6092	−76.0	80.7	+17.0	48	.....	3	Do.
		6090	−70.0	86.7	−15.0	194	.....	1	
		6089	−70.0	86.7	−7.0	35	.....	1	
		6088	−68.0	88.7	+14.0	194	.....	5	

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mt. Wilson group No.	Heliographic			Area		Spot count	Observatory
			Diff. in longitude	Longitude	Latitude	Spot or group	Total for each day		
1938	h m		°	°	°				
Aug. 29...	11 3	6084	−58.0	98.7	+13.0	727	.....	25	U. S. Naval.
		6087	−50.0	106.7	−21.0	6	.....	4	
		6086	−32.0	124.7	−15.0	36	.....	5	
		6078	−25.0	131.7	+29.0	61	.....	15	
		6082	−25.0	131.7	−20.5	6	.....	2	
		6077	+10.0	166.7	+12.5	48	.....	12	
		6085	+35.0	192.7	+9.5	12	.....	2	
		6074	+80.0	236.7	−19.0	145	1,513	3	
Aug. 30...	11 1	6093	−80.0	63.5	+11.0	24	.....	2	Do.
		6092	−62.0	81.5	+17.0	36	.....	2	
		6090	−56.0	87.5	−16.0	242	.....	12	
		6089	−55.0	88.5	−7.0	12	.....	1	
		6088	−54.0	89.5	+14.0	145	.....	4	
		6084	−45.0	98.5	+13.0	485	.....	23	
		6087	−37.0	106.5	−22.0	73	.....	14	
		6086	−19.5	124.0	−17.0	36	.....	6	
		6085	−15.0	128.5	−13.5	12	.....	2	
		6078	−12.5	131.0	+28.5	73	.....	6	
		6077	+26.0	169.5	+12.5	6	1,144	2	
Aug. 31...	11 6	6093	−68.0	62.3	+11.0	121	.....	10	Do.
		6092	−49.0	81.3	+17.0	16	.....	2	
		6090	−42.0	88.3	−16.0	388	.....	9	
		6088	−41.0	89.3	+14.0	97	.....	6	
		6089	−41.0	89.3	−6.5	12	.....	2	
		6084	−32.0	98.3	+13.0	485	.....	33	
		6087	−23.0	107.3	−21.5	24	.....	9	
		6086	−5.0	125.3	−16.0	36	.....	8	
		6078	0.0	130.3	+29.0	36	.....	5	
		6078	+8.0	138.3	+27.0	12	1,227	4	

Mean daily area for 31 days = 1,584. * Not numbered.

AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE in charge]

By B. FRANCIS DASHIELL

The mean free-air data for the month of August 1938, given in tables 1 and 1a, are based on a total of 410 airplane and 214 radiometeorograph observations, respectively. They include the basic meteorological elements of pressure, temperature, and relative humidity, recorded at standard geometric heights. August marked the inauguration of new radiometeorograph stations, and these high-altitude observations are shown in table 1a.

These "means" are computed by the customary method of differences, and are omitted whenever less than 15 observations are made at the surface, and less than 5 at a standard height. For those levels that fall within the limits of the monthly vertical range of the tropopause, at least 15 observations are required. In the January 1938 issue of the MONTHLY WEATHER REVIEW, under "Aerological Observations," the reader will find further details of such computations.

The departures of mean *surface* temperature from the normal during August are shown on chart 1. The month was characterized by a persistence of decidedly warm weather throughout the country, except west of the Continental Divide. The mean temperature was considerably above the normal in the Central States, and it reached a departure of +9° F. over southeastern Nebraska. The remainder of the Central Plains and Mississippi Valley, Ohio Valley, and Middle and North Atlantic States, were also warmer than normal with departures ranging from +2° F. to +6° F.

During August mean free-air temperatures were highest over the Gulf and Southeastern States at 0.5 kilometer, and over the Southwest at all other levels. Although mean surface temperatures during August were unusually high, the mean temperatures *above* the surface showed, in most all cases, only moderate increases over the preceding month of July. On the other hand, however, mean upper-air temperatures for the current month generally were lower at all levels than during the corresponding month of 1937. Greatest positive temperature differences for August over July were noted at 0.5 kilometer over San Diego, Calif. (2.8° C.); at 1 kilometer over Pensacola, Fla. (1.2° C.); at 1.5 and 2 kilometers over El Paso, Tex. (1.2° C. and 1.2° C., respectively); at 2.5 kilometers over Chicago, Ill. (1.5° C.); at 3 kilometers over Chicago, Ill., and Cheyenne, Wyo. (1.3° C.); at 4 kilometers over Cheyenne, Wyo., and Norfolk, Va. (1.2° C.); and at 5 kilometers over Norfolk, Va. (1.7° C.).

The free-air mean temperatures for August, over Seattle and Spokane, Wash., at all levels, were lower than in July. The greatest negative difference at Seattle, Wash., was 4.9° C. at 1.5 and 2 kilometers, while it was 3.5° C. over Spokane, Wash., at 2 kilometers. Negative temperature differences between August 1938 and August 1937 showed that the current month was cooler at most levels over the greater portion of the United States, with the exception of Seattle, Wash., Chicago, Ill., Norfolk, Va., and Pensacola, Fla., where August of this year was warmer.

The highest mean temperatures recorded at all levels were: 24.7° C. at Pensacola, Fla.; 25.3° C. (the highest for the country at any level) over Oklahoma City, Okla.; 23.2° C. and 20.4° C. over El Paso, Tex.; 17.6° C. and 13.7° C. over Salt Lake City, Utah; 6.0° C. over Salt Lake City, Utah, and Oklahoma City, Okla.; and −0.8° C. over Oklahoma City, Okla., at 0.5, 1, 1.5, 2, 2.5, 3, 4, and 5 kilometers, respectively. Low mean temperatures in the free air occurred over the Northwest at all levels, and

temperatures were relatively low over the Great Lakes and New England. The lowest for August (−7.8° C.) was recorded over Sault Ste. Marie, Mich., at 5 kilometers.

The lowest high-altitude temperature (−70.5° C.) was recorded over Washington, D. C., at 16 kilometers. Correspondingly low temperatures for August were found at 16 and 17 kilometers over stations also using radiometeorographs. The low temperatures recorded over stations which are farthest north, however, were somewhat higher than at points farther south but in the same high levels.

Isobaric charts, prepared from the pressure data given in tables 1 and 1a, for all levels up to 5 kilometers, showed that the mean free-air pressure for August over the central, southern, and eastern States, was higher than in July. But it was slightly lower elsewhere, and particularly so along a northern belt extending from Seattle, Wash., to Sault Ste. Marie, Mich. Pressure also was slightly lower over the entire country at all levels during August than in the corresponding month of 1937.

Pressure was high in August 1938 over the Southeast at all levels up to 2 kilometers, than over the southern half of the country east of the southern Rocky Mountain region up to 5 kilometers. Elsewhere the pressure was lower. A statistical low-pressure area appeared at 0.5, 1, and 1.5 kilometers over Fargo, N. Dak., and the northern Rocky Mountain region. At 2 kilometers this area had moved eastward to Sault Ste. Marie, Mich., but was practically nonexistent at 5 kilometers.

Free-air humidity was unevenly distributed over the country during August. The highest humidities recorded at the different levels were found over San Diego, Calif. (81 percent), Nashville, Tenn. (81 percent), and Sault Ste. Marie, Mich. (76 percent), at 0.5 kilometer; over Lakehurst, N. J., Nashville, Tenn., and Sault Ste. Marie, Mich., at 1, 1.5, and 2 kilometers; and over Nashville, Tenn., and Sault Ste. Marie, Mich., at 2.5, 3, 4, and 5 kilometers. Humidity was high over Seattle, Wash. (65 percent at 1 kilometer), up to 2 kilometers, but the air rapidly became much drier from that level (28 percent at 3 kilometers) up to 5 kilometers, inclusive.

In August the mean relative humidities were higher than those recorded during the preceding months of June and July. Over the far Northwest the humidity, up to 2 kilometers, was about 10 percent greater than in July, and from 10 to 20 percent higher in the South and East up to 4 kilometers, but lower over the entire country at 5 kilometers. It was noted, too, that while the areas of high humidity were concentrated over the South during July, they moved toward the North in August and occupied about the same position they did in June. Over Oakland, Calif., where the driest air in the United States was recorded up to 5 kilometers, high-altitude observations showed that the humidity was only 20 percent at 10 kilometers.

Resultant winds in the free atmosphere, based on pilot balloon observations made near 5 a. m. (75th meridian time) during the month of August, are given in table 2. The resultant-wind directions indicated definite departures from the normal almost everywhere, although during the preceding month of July the greatest departures were confined mostly to the southeastern States. As usual, large departures from normal directions were noted at the surface, and at Sault Ste. Marie, Mich., the current resultant wind direction was 100° south of its normal.

The differences between outstanding resultant-wind directions for August and their normals (in degrees), at all levels, were: 55° north of normal (when rotated in a clockwise direction) over Fargo, N. Dak.; 64° south of normal (when rotated counter-clockwise) over Pensacola, Fla.; 69° north of normal, over Seattle, Wash.; 54° north, over Medford, Oreg.; 57° north, over Salt Lake City, Utah; 70° south, and 44° north, over Oklahoma City, Okla.; and 68° south of normal, over Atlanta, Ga.; all at 0.5, 1, 1.5, 2, 2.5, 3, 4, and 5 kilometers, respectively.

Upper-air resultant wind directions over the United States, during August, showed that 77 percent were westerly and 23 percent had easterly components. The winds were found to be 20 percent easterly at 0.5 kilometers, and this ratio remained nearly constant up through all levels to 4 kilometers. At 5 kilometers, 25 percent of all directions showed easterly components. And, of all the easterly winds recorded at every level, the majority fell within the southeast quadrant, while those having westerly components were about equally divided between the northwest and southwest quadrants.

It is interesting to note that, during August, many pilot balloon stations reported resultant wind directions having departures that were south of normal, when rotated counterclockwise. Such southerly departures occurred at St. Louis, Mo., Chicago, Ill., Detroit, Mich., Sault Ste. Marie, Mich., Fargo, N. Dak., Omaha, Nebr., Oklahoma City, Okla., and Cheyenne, Wyo. These departures, it will be seen, were confined generally to an area that covered the entire central portion of the United States, and extended from the Gulf to the Canadian border. Since this condition existed at most levels, and can be compared with the high temperatures which persisted during August over the same area, it becomes significant. Resultant wind directions which were north of normal, at most levels, occurred over the Eastern and Western States where mean temperatures were considerably less than those recorded in the Central States.

At Key West, Fla., departures in resultant winds from normal were in a counter-clockwise direction as opposed to the situation that prevailed during July when wind directions at all levels over Key West departed from normal in a clockwise direction. But, at Pensacola, Fla., the August departures in direction were very similar to those noted in July, except that a clockwise departure occurred at 4 kilometers. Nashville, Tenn., was the only station in the country reporting departures that turned north of normal at all levels, while St. Louis, Mo., as in July, showed the most nearly normal wind directions at all levels in the United States.

Wind velocities for August were somewhat higher than normal over most of the United States at all levels up to 4 kilometers. Such was the case over all balloon stations at 1 kilometer, as well as at 1.5 kilometers, except over Seattle, Wash. Large positive departures from the normal resultant-wind velocity occurred over Key West, Fla., at 2, 2.5, 3, and 4 kilometers, and smaller positive departures over Fargo, N. Dak., and Detroit, Mich., at 1 kilometer, and over Sault Ste. Marie, Mich., at 2.5 and 3 kilometers. Negative departures of resultant velocity were slight whenever they occurred, except at Boston, Mass., where the velocity was 5.3 m. p. s. less than normal.

Table 3 shows the maximum winds recorded in August. A velocity of 69.8 m. p. s. (157 miles per hour) occurred from the SSW at 2.6 kilometers over Havre, Mont., on the 11th. Maximum winds elsewhere were not excessive, but in the very high levels a wind speed of 64.5 m. p. s. from the WSW was observed over Redding, Calif., at 24.7 kilometers.

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TABLE 1.—*Mean free-air barometric pressures (P) in mb., temperatures (T) in ° C., and relative humidities (R. H.) in percent obtained by airplanes during August 1938*

Stations and elevations in meters above sea level	Altitude (meters), m. s. l.																											
	Surface				500			1,000			1,500			2,000			2,500			3,000			4,000			5,000		
	Number of obs.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.
Billings, Mont. (1,090 m)	30	892	17.4	51	----	----	----	----	----	----	850	20.3	41	802	17.3	40	756	13.6	43	712	9.7	48	630	2.1	56	556	−4.9	58
Cheyenne, Wyo. (1,873 m)	31	815	15.4	64	----	----	----	----	----	----	803	17.5	56	757	16.5	50	714	13.2	48	633	5.4	52	559	−3.2	62	----	----	----
Chicago, Ill. (187 m)	31	994	20.4	85	960	22.1	70	906	19.9	71	855	17.2	69	806	15.0	63	759	12.2	57	715	9.2	53	633	2.9	51	559	−3.0	45
Coco Solo, C. Z.[1] (15 m)	25	1,009	24.2	94	955	23.3	84	902	20.6	82	850	18.1	79	802	15.5	78	756	13.4	68	712	10.7	66	630	4.7	72	558	−0.8	70
El Paso, Tex. (1,193 m)	31	883	21.8	54	----	----	----	----	----	----	853	23.2	46	805	20.4	47	759	16.6	52	716	12.5	58	634	4.5	66	560	−2.8	68
Lakehurst, N. J.[1] (39 m)	31	1,010	20.1	91	958	22.3	64	904	18.4	68	852	14.3	75	803	11.0	73	756	8.1	63	711	5.2	55	627	−0.9	53	----	----	----
Norfolk, Va.[1] (10 m)	30	1,016	23.4	93	961	23.4	72	907	20.4	69	858	17.2	66	807	14.7	64	760	12.1	57	716	9.6	52	633	4.2	44	560	−2.6	42
Pearl Harbor, T. H.[1] (6 m)	31	1,014	23.4	85	959	22.3	80	904	19.2	83	853	16.5	82	804	14.3	76	757	13.4	60	713	12.3	43	632	8.0	35	560	3.2	34
Pensacola, Fla.[1] (13 m)	29	1,017	23.7	94	962	24.7	69	909	21.8	61	857	18.4	61	809	15.3	55	761	12.0	56	717	9.0	54	634	3.1	51	560	−2.4	48
St. Thomas, V. I.[1] (8 m)	31	1,015	27.7	75	959	22.7	86	906	19.5	86	854	17.0	81	806	16.0	65	759	13.6	55	715	10.4	50	633	3.9	49	560	−1.4	46
Salt Lake City, Utah (1,288 m)	31	871	19.0	50	----	----	----	----	----	----	850	23.0	39	803	20.9	35	758	17.6	35	714	13.7	38	634	6.0	46	560	−1.7	58
San Diego, Calif.[1] (10 m)	29	1,013	19.2	86	957	18.1	81	903	22.6	51	852	22.5	38	804	20.1	36	758	16.6	37	714	12.7	38	633	4.9	44	559	−2.4	51
Seattle, Wash.[1] (10 m)	19	1,019	15.8	74	961	13.4	74	906	12.1	67	852	10.2	59	803	8.3	50	755	6.3	37	710	3.9	28	627	−2.1	28	----	----	----
Spokane, Wash. (597 m)	31	945	13.4	57	----	----	----	902	19.4	37	850	16.7	36	802	13.0	39	755	9.2	42	710	5.6	45	628	−0.8	47	553	−7.6	46

Observations taken about 4 a. m. 75th meridian time, except by Navy stations along the Pacific coast and Hawaii, where they are taken at dawn.

[1] Navy.

NOTE.—None of the means included in this table are based on less than 15 surface or 5 standard-level observations.

TABLE 1a.—*Mean free-air barometric pressures (P) in mb., temperatures (T) in °C., and relative humidities (R. H.) in percent obtained by radiometeorographs during August 1938*

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level																											
	Fargo, N. Dak. (274 m)				Nashville, Tenn. (180 m)				Oakland, Calif. (2 m)				Oklahoma City, Okla. (391 m)				Omaha, Nebr. (300 m)				Sault Ste. Marie, Mich. (221 m)				Washington, D. C. (13 m)[1]			
	Number of obs.	P	T	R. H.	Number of obs.	P	T	R. H.	Number of obs.	P	T	R. H.	Number of obs.	P	T	R. H.	Number of obs.	P	T	R. H.	Number of obs.	P	T	R. H.	Number of obs.	P	T	R. H.
Surface	31	979	17.7	73	31	996	22.1	91	31	1,014	14.1	85	31	970	23.5	71	31	979	22.1	80	31	988	15.1	93	29	1,016	21.3	88
500	31	954	20.7	65	31	960	23.1	81	31	957	15.1	74	31	958	24.4	67	31	958	22.8	72	31	957	16.9	84	29	960	21.9	73
1,000	31	900	20.6	56	31	907	21.1	76	31	902	20.4	45	31	905	25.3	57	31	904	22.7	62	31	902	16.0	76	29	907	19.4	71
1,500	31	850	18.1	53	31	856	18.3	72	31	852	19.8	34	31	855	22.8	55	31	854	21.4	58	31	850	12.9	77	29	854	15.9	71
2,000	31	801	15.0	51	31	807	15.1	67	31	803	17.6	29	31	807	19.5	56	31	806	18.5	54	31	800	9.8	74	29	806	12.7	69
2,500	31	755	11.6	51	31	760	12.0	65	31	757	14.8	27	31	761	16.4	57	31	760	15.1	56	31	754	7.4	71	28	758	9.5	68
3,000	31	711	7.9	52	31	716	8.6	62	31	713	11.7	27	31	718	12.9	56	31	716	11.6	55	31	709	4.4	69	28	714	6.8	64
4,000	29	629	0.4	55	31	634	2.3	58	31	632	4.2	26	31	636	6.0	50	31	634	3.3	55	31	626	−1.7	61	28	631	1.4	58
5,000	29	554	−6.8	56	31	560	−3.7	55	31	558	−2.9	27	31	562	−0.8	44	31	560	−3.9	58	30	552	−7.8	57	27	557	−4.5	53
6,000	29	487	−13.2	52	31	493	−9.1	50	31	491	−9.3	24	31	495	−7.0	40	30	492	−10.8	56	28	485	−14.2	54	27	489	−10.5	48
7,000	28	426	−20.5	48	31	432	−15.5	44	30	430	−16.9	22	31	435	−13.8	36	30	432	−17.7	51	26	424	−21.4	49	27	429	−17.4	45
8,000	28	372	−27.7	46	30	378	−22.2	41	30	377	−24.5	21	31	380	−21.2	34	30	377	−24.2	48	26	370	−28.6	48	25	374	−24.4	43
9,000	27	322	−35.1	44	30	329	−29.7	38	29	327	−32.6	20	31	332	−28.8	33	29	328	−31.6	46	23	320	−36.2	47	25	326	−31.7	41
10,000	27	279	−42.6	----	30	285	−37.7	37	28	284	−40.6	20	31	288	−36.4	33	29	284	−39.4	45	22	277	−43.1	46	24	282	−39.4	----
11,000	27	240	−49.5	----	29	246	−45.1	----	27	244	−46.9	----	31	248	−44.0	----	29	245	−46.5	----	21	238	−48.8	46	24	243	−47.1	----
12,000	27	206	−55.3	----	29	212	−52.3	----	26	210	−52.6	----	31	214	−50.3	----	29	210	−53.3	----	20	204	−53.1	44	24	209	−54.8	----
13,000	26	175	−59.3	----	29	180	−59.3	----	25	179	−56.8	----	30	183	−56.9	----	28	180	−59.3	----	18	175	−56.4	----	22	178	−61.2	----
14,000	25	150	−61.2	----	29	154	−65.0	----	24	153	−60.0	----	30	156	−62.5	----	27	153	−63.8	----	18	149	−59.0	----	19	151	−66.4	----
15,000	21	127	−62.9	----	25	130	−68.4	----	18	130	−63.0	----	20	132	−66.4	----	20	130	−67.7	----	11	127	−60.6	----	13	128	−69.1	----
16,000	14	108	−63.7	----	19	110	−69.8	----	8	110	−64.1	----	13	112	−68.7	----	17	110	−69.5	----	8	108	−61.8	----	5	108	−70.5	----
17,000	7	92	−63.4	----	12	94	−70.3	----	----	----	----	----	10	95	−69.1	----	----	----	----	----	----	----	----	----	----	----	----	----
18,000	----	----	----	----	8	79	−69.4	----	----	----	----	----	9	80	−67.8	----	----	----	----	----	----	----	----	----	----	----	----	----
19,000	----	----	----	----	8	67	−68.3	----	----	----	----	----	9	68	−66.8	----	----	----	----	----	----	----	----	----	----	----	----	----
20,000	----	----	----	----	8	57	−66.1	----	----	----	----	----	6	58	−65.3	----	----	----	----	----	----	----	----	----	----	----	----	----
21,000	----	----	----	----	5	48	−65.0	----	----	----	----	----	5	49	−62.9	----	----	----	----	----	----	----	----	----	----	----	----	----

Observations taken about 4 a. m. 75th meridian time, except by Navy stations along the Pacific coast and Hawaii where they are taken at dawn.

[1] Navy.

NOTE.—None of the means included in this table are based on less than 15 surface or 5 standard-level observations.
Number of observations refers to pressure only as temperature and humidity data are missing for some observations at certain levels also the humidity data are not used where daily temperature readings were below −40° C.

TABLE 2.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during August 1938*

[Wind from N=360°, E=90°, etc.]

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,095 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (157 m)		Detroit, Mich. (204 m)		Fargo, N. Dak. (283 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)		Nashville, Tenn. (194 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	16	0.6	289	1.4	260	1.5	274	2.0	276	2.4	210	1.1	96	0.5	262	1.8	198	1.0	70	0.4	95	3.6	181	0.5	220	0.9
500	------	------	284	3.3	------	------	307	4.8	------	------	227	4.9	234	2.4	270	4.2	231	2.9	178	5.2	101	7.7	273	.8	237	3.8
1,000	------	------	300	3.3	------	------	308	4.6	------	------	250	4.4	258	3.7	271	6.1	251	7.1	157	5.7	105	7.4	306	1.5	265	4.7
1,500	------	------	298	3.2	249	1.9	295	5.0	------	------	264	5.5	268	4.0	270	7.2	253	7.3	146	5.4	102	6.7	335	.5	282	4.3
2,000	184	2.2	296	3.2	248	2.2	287	5.9	273	3.8	277	6.0	277	4.1	282	6.5	254	8.5	137	5.2	94	6.7	208	.4	298	4.2
2,500	230	2.2	310	3.2	252	3.2	294	6.9	246	4.1	281	6.5	280	4.2	293	7.4	270	8.6	139	4.5	91	6.9	234	3.5	298	4.9
3,000	237	3.2	316	2.8	259	5.6	295	7.6	253	3.9	289	7.0	291	6.0	303	8.9	284	9.3	128	4.1	96	6.5	229	5.1	315	4.3
4,000	220	2.4	306	1.8	260	9.1	------	------	254	5.9	325	8.6	313	5.6	315	9.1	276	11.3	106	3.5	85	5.3	236	5.8	291	2.8
5,000	136	1.2	218	.9	278	10.2	------	------	243	9.9	------	------	------	------	307	9.4	------	------	103	4.0	------	------	257	6.5	------	------

Altitude (meters) m. s. l.	Newark, N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Pearl Harbor, Territory of Hawaii [1] (68 m)		Pensacola, Fla. [1] (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,292 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washington, D. C. (10 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	269	1.3	243	1.0	175	4.9	160	2.6	------	------	288	0.2	198	1.0	148	3.4	2	1.1	268	0.5	138	0.8	68	1.4	267	0.6
500	287	5.3	269	2.1	187	7.9	178	5.7	------	------	232	.5	219	4.1	------	------	346	2.2	260	3.1	42	1.8	------	------	287	4.6
1,000	302	5.7	306	4.8	210	13.8	219	8.2	------	------	138	1.5	249	5.4	------	------	339	1.8	282	5.5	45	1.7	232	3.0	304	5.2
1,500	296	5.3	281	3.1	213	9.1	232	6.8	------	------	153	.9	266	6.0	156	4.7	318	.6	297	6.4	45	.5	238	3.9	299	4.9
2,000	306	6.3	251	3.7	216	4.8	244	6.0	------	------	108	.4	273	5.8	181	4.1	162	1.1	298	8.1	304	1.3	232	4.9	296	6.1
2,500	303	7.1	237	4.2	207	2.9	260	5.5	------	------	96	.6	268	4.5	210	3.9	150	3.0	290	9.8	302	1.4	239	5.9	294	6.8
3,000	307	6.2	------	------	159	2.3	286	5.2	------	------	47	1.8	279	3.8	234	4.1	134	4.6	278	10.4	281	4.8	244	7.4	289	6.8
4,000	302	2.0	------	------	123	1.9	285	8.6	------	------	65	4.0	323	3.4	241	6.2	------	------	------	------	------	------	249	10.3	291	8.8
5,000	------	------	------	------	85	3.7	275	8.3	------	------	------	------	298	3.6	247	7.3	------	------	------	------	------	------	258	8.9	292	8.5

[1] Navy stations.

TABLE 3.—*Maximum free air wind velocities (M. P. S.), for different sections of the United States based on pilot balloon observations during August 1938*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m), m. s. l.	Date	Station
Northeast [1]	29.8	WNW	2,260	11	Newark, N. J.	29.2	WNW	3,360	24	Pittsburgh, Pa.	33.6	WSW	9,880	1	Cleveland, Ohio.
East-Central [2]	26.6	WNW	2,250	24	Washington, D. C.	30.4	NW	3,330	24	Washington, D. C.	28.0	N	9,720	30	Greensboro, N. C.
Southeast [3]	22.6	ESE	1,180	10	Key West, Fla.	19.9	WNW	4,840	27	Spartanburg, S. C.	20.8	E	10,180	10	Jacksonville, Fla.
North-Central [4]	33.8	SSW	1,380	13	Huron, S. Dak.	34.8	W	3,720	19	Huron, S. Dak.	54.0	WSW	12,210	16	Fargo, N. Dak.
Central [5]	29.6	SW	1,300	19	Omaha, Nebr.	34.3	WNW	4,410	25	Moline, Ill.	36.0	WSW	9,720	19	Omaha, Nebr.
South-Central [6]	27.6	ESE	1,300	25	Del Rio, Tex.	23.1	E	3,530	24	New Orleans, La.	41.0	WSW	18,910	27	Abilene, Tex.
Northwest [7]	36.0	S	2,500	11	Havre, Mont.	69.8	SSW	2,660	11	Havre, Mont.	59.2	W	14,140	16	Billings, Mont.
West-Central [8]	26.6	W	2,290	21	Cheyenne, Wyo.	36.3	W	4,420	19	Denver, Colo.	64.5	WSW	24,750	4	Redding, Calif.
Southwest [9]	21.3	S	1,770	17	Albuquerque, N. M.	30.3	SW	3,540	13	Las Vegas, Nev.	54.0	WSW	20,340	3	Las Vegas, Nev.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode, Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, northern Nevada, and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

RIVERS AND FLOODS

[River and Flood Division, MERRILL BERNARD in charge]

By BENNETT SWENSON

Atlantic Slope drainage.—Moderate to heavy floods in the Roanoke, Neuse, Tar, and Cape Fear Rivers in North Carolina which began late in July continued the first few days of August in most cases. The flood in the Neuse River was the heaviest in 9 years as far downstream as Smithfield, N. C. The overflow in the Roanoke River was a lower river flood, where the stage at Weldon, N. C., rose from 12.3 feet on July 20 to 44.1 feet on July 28, due to a concentration of water following frequent heavy rains.

East Gulf of Mexico drainage.—Heavy rains on August 1–2, followed by additional heavy rains on the 7–8th over the Pearl and Pascagoula River Basins caused general rises in these rivers. Flood stage was exceeded only at one of the river gaging stations, namely Pearl River, La., on the Pearl River. At that point the stage reached 12.3 feet on August 11. The main loss was caused by the forced suspension of activities by the lumbering interests.

Missouri Basin.—Late reports indicate that flood stages occurred in the Big Sioux River from July 2 to 7. Heavy rains in the upper Big Sioux Valley caused a rise at Akron, Iowa, of 7 feet in the 24 hours ending at 8 a. m. July 2. The crest was reached at that place at 7:45 a. m. July 4, with a stage of 17.55 feet (flood stage 12 feet). Damages, mostly to growing crops, are estimated at $116,000.

Ohio Basin.—An unusually severe storm occurred in the Great Smoky Mountains about midnight of August 4 and excessive rain continued for about 3 hours. Severe flash floods resulted on the morning of August 5 in the headwaters of the Little Pigeon and Little Rivers in Sevier and Blount Counties in Tennessee. The Tennessee Valley Authority reports that the area of most severe rainfall seems to have extended from the general vicinity of Calderwood, Tenn., on the Little Tennessee River, in a general northeast direction to the vicinity of Cosby, Tenn., on the Pigeon River. Unofficial records inaicate that more than 9 inches of rain fell in about 3 hours at one point near Pittman Center in the region of the middle fork of the Little Pigeon River.

The greatest damage from the floods occurred along Webb Creek, Ball Branch, Laurel and Roaring Branch Creeks, and the middle fork of the Little Pigeon River. Eight lives were lost in the vicinity of Webb Creek.

Another severe local storm occurred about midnight August 8 over Brush Creek, a tributary of Watauga River, and resulted in flooding of Johnson City, Tenn., causing considerable damage.

West Gulf of Mexico drainage.—A destructive flood occurred in the Colorado River from July 22 to August 3. Six lives were lost and property and crop losses are estimated at more than $5,000,000. A complete report on this flood will be made in the next issue of the Review.

The flood in the lower Rio Grande that was in progress at the close of July and the beginning of August caused little damage. Another flood occurred near the close of August and a report on this flood will be made later.

Estimated flood losses by drainage basins during August 1938 are as follows:

Atlantic Slope drainage:	
Roanoke River	[1] $244,000
Neuse River	[1] 13,600
Cape Fear River	[1] 4,000
Tar River	[1] 10,500
East Gulf of Mexico drainage:	
Pearl River	5,000
Ohio Basin:	
Little Pigeon and Little Rivers (Sevier and Blount Counties, Tenn.)	85,000
Brush Creek (Johnson City, Tenn.)	106,000
Green River in Kentucky	10,000
West Gulf of Mexico drainage:	
Colorado River in Texas	[1] 5,200,000
Rio Grande	[1] 1,100
Gulf of California drainage:	
Colorado River in Arizona	16,200
Total	5,695,400

[1] July and August.

Table of flood stages during August 1938

[All dates in August unless otherwise indicated]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE	Feet			Feet	
James: Columbia, Va.	10	4	11	15.4	5
Roanoke: Williamston, N. C.	10	July 26	14	13.7	July 31, 1
Tar:					
Tarboro, N. C.	18	July 30	1	20.2	1
Greenville, N. C.	13	July 28	4	15.0	2
Neuse:					
Neuse, N. C.	14	July 24	1	22.0	July 29
Goldsboro, N. C.	14	July 27	8	19.2	4
Santee:					
Rimini, S. C.	12	July 25	1	14.4	July 31
Ferguson, S. C.	12	July 28	6	13.4	1
Savannah: Clyo, Ga.	11	July 30	12	17.6	3
Altamaha: Charlotte, Ga.	12	July 28	6	13.4	4–5
EAST GULF OF MEXICO DRAINAGE					
Pearl: Pearl River, La.	12	10	13	12.3	11
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Rock: Moline, Ill.	10	19	19	10.0	19
Ohio Basin					
Barren: Bowling Green, Ky.	20	1	2	21.1	2
Green: Lock No. 4, Woodbury, Ky.	33	1	3	35.3	2
Lower Mississippi Basin					
Big Lake Outlet: Manila, Ark.	10	5	9	10.4	6–7
WEST GULF OF MEXICO DRAINAGE					
Colorado:					
Marble Falls, Tex.	21	July 22	July 28	36.4	July 25
Austin, Tex.	21	July 23	July 27	33.0	July 25
Smithville, Tex.	25	July 25	July 29	34.3	July 27
Columbus, Tex.	24	July 25	1	38.4	July 29
Wharton, Tex.	26	July 25	3	37.4	July 30
Nueces: Cotulla, Tex.	15	July 30	2	17.0	July 31
Rio Grande:					
Rio Grande City, Tex.	21	29	Sept 1	30.1	31
Hidalgo, Tex.	21	30	Sept. 3	24.6	Sept. 2
Mercedes, Tex.	21	31	Sept. 3	22.2	Sept. 2
Brownsville, Tex.	18	1	2	18.1	2

WEATHER ON THE ATLANTIC AND PACIFIC OCEANS

[The Marine Division, I. R. TANNEHILL in charge]

NORTH ATLANTIC OCEAN, AUGUST 1938

By H. C. HUNTER

Atmospheric pressure.—The pressure was slightly to moderately in excess of normal over the eastern North Atlantic, likewise over the middle of the ocean from the vicinity of the Grand Banks southward. Near the United States coast the pressure was above normal from New Jersey southwestward. There were moderate deficiencies of pressure from New England and Nova Scotia southeastward and southward to the central and eastern West Indies and also in the vicinity of southern and western Greenland.

The highest pressure yet reported by a vessel during the month was 30.47 inches, by the British motor tanker *Wellfield*, near 37° north, 33° west, during the forenoon of the 11th. There was very low pressure near the northwestern tip of Yucatan early on the 26th, in connection with the most important of the tropical disturbances; the American steamship *Agwister* reported 28.92 inches. Elsewhere the lowest reported pressure was 29.24 inches on the American liner *Mormactide*, in the northern part of the North Sea, 58° N., 5° E., about noon of the 20th. Several land stations of the British Isles and Norway noted somewhat lower readings during the period from August 17 to 21.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, August 1938.*

Station	Average pressure	Departure	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Julianehaab, Greenland	29.74	−0.08	30.14	31	29.36	2
Reykjavik, Iceland	29.83	+.02	30.24	29	29.26	18
Lerwick, Shetland Islands	29.91	+.11	30.36	2, 3	29.00	17
Valencia, Ireland	30.00	+.08	30.36	2	29.18	19
Lisbon, Portugal	30.03	+.01	30.12	1, 4, 5, 7	29.83	28
Madeira	30.09	+.06	30.30	17	29.97	6
Horta, Azores	30.29	+.09	30.40	11	30.08	22
Belle Isle, Newfoundland	29.89	.00	30.30	17	29.58	23
Halifax, Nova Scotia	29.95	−.06	30.24	21	29.44	25
Nantucket	29.97	−.02	30.20	21	29.57	24
Hatteras	30.04	+.04	30.24	14	29.79	25
Bermuda	30.10	−.04	30.24	5, 7, 8	29.94	26
Turks Island	30.00	−.04	30.09	13	29.93	24
Key West	30.01	+.03	30.14	14	29.89	24
New Orleans	30.04	+.06	30.23	4	29.89	1

NOTE.—All data based on a. m. observations only, with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Extra-tropical cyclones and gales.—On various dates, in widely scattered parts of the ocean to northward of the 35th parallel, fresh gales were met by a few vessels, but no reports are found in these areas of any wind force exceeding 8. The most notable LOW system of the month was indicated on the morning of the 14th as extending from southern Greenland to North Dakota, with three distinct centers, each of considerable energy. By the 16th the system had moved eastward so that it reached from Lapland to Baffin Land, with an important center just north of Scotland. By the 19th this particular center was over northern Sweden, but the succeeding center attained marked strength near the Shetland Islands, whence it advanced in turn to the Scandinavian peninsula. Table 1 shows a reading of exactly 29 inches at Lerwick on the 17th, but even lower readings were noted at some Norwegian stations, namely, 28.94 at Bronno, about noon of the 20th, and 28.91 during the night preceding at Ingöy. From mid-Atlantic eastward and northeastward several vessels were involved in moderate or fresh gales in connection with the different centers of this system.

An energetic squall over the western part of Long Island Sound during the afternoon of the 24th capsized a few small sailboats, but it is thought that all on these craft were rescued.

Tropical disturbances.—Elsewhere in this issue may be found an account of the three tropical disturbances of August; these affected parts of the Caribbean Sea and Gulf of Mexico and a small portion of the Atlantic Ocean itself close to the Leeward Islands and the Greater Antilles. An accompanying chart indicates the tracks of these disturbances.

As the American steamship *West Isleta* encountered the first of these disturbances in the eastern Caribbean during the night of the 7–8th, it met "heavy squalls of hurricane intensity." The second disturbance, when it had reached the Gulf of Mexico, was the cause of force-11 winds, met by the American steamer *John D. Archbold*, on the 14th.

The third and most intense storm has already been mentioned in the text under "Atmospheric pressure." It seems to have been particularly severe when near the northwest tip of Yucatan, on the morning of the 26th. The conditions of this day are shown on chart IX. Reports of full hurricane intensity have come from two American steamships, *Agwistar* and *Mexico*, which were near Yucatan that morning; and a message from Nicaraguan motorship *Sama*, which encountered the storm in the southwestern part of the Gulf of Mexico the next night, indicates that hurricane force persisted over the gulf for fully 18 hours.

Fog.—Ordinarily fog over the North Atlantic decreases in amount from July to August. However, this year there was about as much, on the whole, in the latter month. While there was less fog to the southeastward of Nova Scotia, in the Gulf of St. Lawrence, and along the chief lanes between 45° and 35° west longitude, yet between the 35th meridian and northwestern Europe there was more fog than in July.

In general, the August fogginess this year was considerably greater than usual for the month, particularly in the eastern portion to northward of the 45th parallel.

The leading 5° squares and the number of days with fog in these squares are: the westernmost parts, 40° to 45° N., 65° to 70° W., with 20 days; the region over or near the Grand Banks, 45° to 50° N., 45° to 50° W., with 17 days; the eastern parts, 45° to 50° N., 20° to 25° W., with 16 days. The eastern parts had but little fog between the 15th and the 25th of August, while the westernmost experienced very little after the 23d.

OCEAN GALES AND STORMS, AUGUST 1938

Vessel	Voyage		Position at time of lowest barometer		Gale began August—	Time of lowest barometer August—	Gale ended August—	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Direction and highest force of wind	Shifts of wind near time of lowest barometer
	From—	To—	Latitude	Longitude									
NORTH ATLANTIC OCEAN			° ′	° ′				*Inches*					
Cefalu, Hond. S. S.	Cristobal	Puerto Cabezas	11 36 N.	82 00 W.	3	7p, 3	4	29.86	NE.	NE, 5	NE.	NE, 6	
Susan B. Luckenbach, Am. S. S.	do	New York	15 50 N.	75 57 W.	6	7a, 6	7	29.94		E, 3		NE, 9	
West Isleta, Am. S. S.	Trinidad	do	17 36 N.	63 06 W.	7	8a, 7	8	29.92	ENE.	NE, 5	E.	E, 12	NE-ENE.
New York, U. S. Navy	Antwerp	Norfolk	36 42 N.	71 18 W.	8	7a, 9	9	30.02		W, 8		W, 8	
Santa Rita, Am. M. S.	New York	Cristobal	21 16 N.	74 15 W.	9	2p, 9	9	29.80	NE.	SSE, 6	SSE.	E, 8	NE-SSE.
Falcon, Am. S. S.	Cristobal	Baltimore	22 12 N.	74 24 W.	8	4p, 9	10	29.81	NE.	E, 9	E.	E, 9	NE-E.
Tela, Hond. S. S.	Puerto Barrios	Charleston	[1] 23 18 N.	83 21 W.	10	4p, 10	10	29.59	E.	ENE, 5	E.	E, 6	ENE-E.
Lysefjord, Nor. S. S.	Santiago	Kingston	[1] 18 16 N.	76 03 W.	11	4a, 12	12	29.99	E.	ESE, 6	ESE.	ESE, 7	
West Harshaw, Am. S. S.	Gibraltar	Jucaro, Cuba	21 11 N.	82 54 W.	12	9a, 12	12	29.89	E.	E, 8	SE.	SSE, 8	NE-SSE.
McDougal, U. S. Navy	Pensacola	Cristobal	22 12 N.	85 12 W.	12	10p, 12	13	29.94	E.	E, 9	SE.	E, 9	E-SSE.
Darien, Pan. S. S.	Cortez	Mobile	20 20 N.	86 37 W.	12	1a, 13	13	29.79	S.	SSE, 6	SSE.	SSE, 7	S-SSE.
St. Mary, Br. S. S.	Baltimore	Alvaro Obregon	23 30 N.	88 00 W.	13	5a, 13	13	29.94	SE.	E, 6	ESE.	SSE, 8	E-SSE.
Teresa Odero, Ital. M. S.	Baytown, Tex.	Gibraltar	[1] 27 43 N.	90 46 W.	14	4a, 14	14	30.03	ESE.	ESE, 8	SE.	ESE, 10	E-SE.
John D. Archbold, Am. S. S.	New York	Corpus Christi	26 42 N.	91 36 W.	14	4a, 14	14	29.78	ESE.	SE, 8	S.	S, 11	ESE-SSE.
J. A. Moffett, Jr., Am. M. S.	Corpus Christi	New York	26 38 N.	92 07 W.	14	5a, 14	14	29.63	SSW.	Calm	S.	SSW, 8	E-Calm-SSW.
W. C. Fairbanks, Am. S. S.	Smiths Bluff, Tex.	Gulfport, N. Y.	28 20 N.	91 40 W.	14	3p, 14	14	29.81	SE.	S, 9	S.	S, 9	SE-S.
Scanmail, Am. S. S.	Copenhagen	New York	57 12 N.	25 30 W.	15	7p, 15	15	29.35	SW.	WSW, 7	WNW.	WNW, 8	WSW-WNW.
Maja, Du. M. S.	Curacao	Gibraltar	20 28 N.	55 13 W.	18	3p, 18	19	29.85	NE.	ENE, 6	ESE.	E, 8	NE-ESE.
De Grasse, Fr. S. S.	Southampton	New York	49 59 N.	22 21 W.	22	10a, 22	23	29.69	W.	SSW, 7		W, 8	S-W.
Annie Johnson, Swed. M. S.	Cristobal	London	14 00 N.	73 47 W.	23	5a, 23	23	29.70	ESE.	ESE, 4	ENE.	SE, 7	NE-SE.
Cristobal, Am. S. S.	do	Port au Prince	15 46 N.	75 50 W.	23	7a, 23	23	29.72	ENE.	ENE, 5	ESE.	ESE, 7	ENE-ESE.
Sunbeam, Am. S. S.	Montreal	Port Arthur	39 35 N.	68 00 W.	24	Noon, 24	24	29.55	SW.	SW, 7	NNW.	NW, 8	SW-NNW.
Tolos, Am. S. S.	Havana	Cristobal	19 16 N.	80 31 W.	24	4p, 24	25	29.77	ENE.	ESE, 7	SE.	ESE, 7	ENE-SE.
Agwistar, Am. S. S.	Progreso	New York	[1] 21 23 N.	89 39 W.	25	6a, 26	26	[2] 28.92	N.	Calm	SE.	S, 12	N-Calm-S.
Mexico, Am. S. S.	Vera Cruz	Havana	22 00 N.	89 54 W.	26	9a, 26	26	29.25	N.	ENE, 10	SE.	NE, 12	NE-ESE.
St. Mary, Br. S. S.	New Orleans	Frontera	21 18 N.	91 36 W.	27	6p, 28	29	29.80	ESE.	NE, 7	E.	NE, 7	ESE-NE-E.
Agwidale, Am. S. S.	Progreso	Tampico	22 08 N.	94 00 W.	28	6p, 28	29	29.78	ESE.	ESE, 6	E.	ESE, 7	None.
NORTH PACIFIC OCEAN													
Mobile City, Am. S. S.	Honolulu	Balboa	16 54 N.	114 42 W.	1	4a, 2	2	29.68	NNW.	WSW, 6	SW.	SW, 7	NNW-SSW.
Do	do	do	14 54 N.	106 18 W.	4	5a, 4	4	29.82	NE.	NE, 6	SE.	NE, 9	
Hopemount, Br. M. S.	Tarahan	Fusan	[1] 30 00 N.	125 34 E.	9	2a, 9	9	[2] 28.74	WNW.	WNW, 8	W.	W, 8	NW-SW.
Empress of Canada, Br. S. S.	Shanghai	Hong Kong	30 56 N.	122 58 E.	9	2p, 9	9	28.78	N.	NE, 6	SSW.	NNW, 11	NNW-NE-S.
Silvermaple, Br. M. S.	Manila	Portland, Ore.	32 45 N.	157 00 E.	9	4p, 9	10	29.65	ENE.	ESE, 8	S.	ESE, 8	ENE-SE.
Bronxville, Nor. M. S.	Los Angeles	Yokohama	47 10 N.	180 00	19	4a, 21	21	29.84	SE.	WSW, 8	NW.	WSW, 8	SE-SW-NW.
Atago Maru, Jap. M. S.	Yokohama	Honolulu	31 36 N.	175 12 E.	20	Noon, 20	21	29.79	E.	NE, 8	ESE.	NE, 8	NE-ESE.
Northland, U. S. C. G.	Bering Sea	Norton Sound	66 12 N.	169 54 W.	21	1a, 21	22	29.22		ESE, 5	SSW.	S, 8	ESE-SSW.
Nozima Maru, Jap. M. S.	Yokohama	Los Angeles	46 18 N.	175 00 W.	29	Mdt., 29	30	29.54	W.	SSW, 4	W.	W, 8	

[1] Position approximate.
[2] Barometer uncorrected.

NORTH PACIFIC OCEAN, AUGUST 1938

By WILLIS E. HURD

Atmospheric pressure.—Most of the eastern half of the North Pacific Ocean north of the Tropics was under the influence of anticyclonic conditions during the greater part of August. Very few LOWS entered this part of the ocean in middle latitudes, and those that crossed in higher latitudes had little intensity. The Aleutian LOW, weakly developed, lay over the Bering Sea. In the northeastern waters and along the adjacent coast pressures were higher than the normal of the month. The greatest departure was at Kodiak, where the average pressure, 30.10 inches, was 0.24 inch above. In tropical waters practically normal conditions prevailed.

Extratropical cyclones and gales.—A few extratropical disturbances of mild to moderate intensity occurred along the western part of the steamship routes, but the only one west of the 170th meridian of east longitude reported to have caused a high wind was that of the 9th, in which the British motorship *Silvermaple* experienced a force 8 gale, near 33° N., 157° E. A gale of like force near 32° N., 175° E., was met by the Japanese motorship *Atago Maru* on the 20th, in connection with a disturbance central far to the northward.

In higher latitudes a few LOWS entered into or developed over the Aleutian region, where they were for the most part central in the Bering Sea. None of these disturbances penetrated the Gulf of Alaska. In connection with these mild cyclones, ships experienced fresh local gales (force 8) on the 21st and 29th south of the central Aleutians, and on the 21st and 22d west of the Alaska Peninsula.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure at sea level, North Pacific Ocean, August 1938, at selected stations*

Station	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Point Barrow	29.82	−0.07	30.08	24	29.44	31
Dutch Harbor	29.98	+.12	30.36	19	29.38	15
St. Paul	29.85	+.07	30.26	23, 24	29.34	15
Kodiak	30.10	+.24	30.34	20	29.72	16
Juneau	30.08	+.06	30.32	21	29.80	1
Tatoosh Island	30.10	+.10	30.29	2	29.77	17
San Francisco	29.95	+.03	30.08	10	29.73	30
Mazatlan	29.86	+.02	29.96	5	29.74	29
Honolulu	29.98	−.03	30.11	14	29.77	19
Midway Island	30.07	−.01	30.24	12	29.94	27, 28
Guam	29.78	−.04	29.89	15	29.53	23
Manila	29.76	+.02	29.83	3, 4, 17	29.65	22
Hong Kong	29.66	.00	29.75	16	29.56	9

NOTE.—Data based on 1 daily observation only, except those for Juneau, Tatoosh Island, San Francisco, and Honolulu, which are based on 2 observations. Departures are computed from best available normals related to time of observation.

Disturbances of the Far East.—Pending receipt of the usual monthly report from the Weather Bureau at Manila on the depressions and typhoons of August in the Far East, there are only scattered comments to make regarding the tropical storms that occurred in these waters.

A press report of August 8 from Tokyo gave information of a severe typhoon approaching Kyushu Island. While we have no information as to the earlier movements of the storm, a special report from the British R. M. S. *Empress of Canada*, Capt. W. T. Kinley, Fourth Officer E. R. Shaw, observer, shows the existence on the 9th of a severe storm east of Shanghai. This steamer, Shanghai to Hong Kong, ran into the gale, of force 8–9 from the north, at 12 noon (China coast time), barometer 29.32. At 1 p. m. the wind had increased to force 11 from the north-northwest, in 30°56′ N., 122°37′ E. At 2 p. m. the vessel entered the cyclone center, with light wind, and barometer 28.78. At 3 p. m. the wind was south, force 10, thereafter diminishing, as the typhoon went inland.

On the 7 p. m. (E. S. T.) map of August 31 a typhoon is shown entering the south coast of Japan near Yokohama. Press reports of September 1 indicate the serious nature of the storm as it affected Yokohama, Tokyo, and neighboring towns and cities. Some 99 persons were reported to have been killed, while damage to property was placed at approximately $28,000,000. About 15,000 of the inhabitants of Tokyo alone were estimated to have been rendered homeless. There was much damage done to shipping, particularly in the harbor of Yokohama, where 34 passenger and freight ships were driven aground and hundreds of small boats were wrecked.

Disturbances of the Southeastern North Pacific.—There are indications from isolated reports that three tropical disturbances occurred in the waters west of Mexico during August. The American steamer *Mobile City*, Honolulu to Balboa, ran into the northerly winds of a westward moving depression late on August 1, and at 4 a. m. of the 2d, in 16°54′ N., 114°42′ W., had a barometer reading of 29.68 inches. The vessel ran out of the depression on the afternoon of the 2d, after experiencing a maximum wind of force 7 from the southwest.

Early on the 4th the same ship encountered a northeast gale of force 9, lowest barometer 29.82, near 15° N., 106° W. Later in the day the wind changed to southeast with lessened force. The indication is that the vessel had passed through the northern half of a second tropical disturbance moving westward in these waters.

The third disturbance was located as a depression over or close to the eastward of the Revillagigedo Islands on the morning of August 18. Twenty-four hours later it lay west or west-southwest of Cape San Lucas, with pressure reported down to 29.50 inches or lower at or near the center. The only gale, a wind of force 8, in connection with it, was reported by an unidentified ship near 25° N., 114° W., on the morning of the 19th. Our 7 p. m. (E. S. T.) map of the 19th shows no further evidence of the cyclone.

Fog.—Along the central part of the northern routes, specifically between about latitudes 44° and 51° N., longitudes 155° and 175° W., there was a concentration of fog, unusual for any summer month in that locality. Over this region fog was reported on at least 23 of the first 26 days of the month. Westward, fog diminished to about 4 days of occurrence east of northern Japan, and eastward it diminished to about 3 days in the coastal waters of Washington and Oregon. South of the 40th parallel there were only isolated occurrences of fog over the ocean, except along the California coast when it was reported on 9 days, and along the Lower California coast, on 3 days.

LATE REPORT: TYPHOONS AND DEPRESSIONS OVER THE FAR EAST, JULY 1938

BERNARD F. DOUCETTE, S. J.
[Weather Bureau, Manila, P. I.]

Typhoon, July 4–10, 1938.—From July 4 to 7 a very shallow low pressure area moved from the Pacific across the Visayan Islands into the China Sea along a west-northwesterly course. As the disturbance approached the regions south of the Paracel Islands and Reefs, it quickly intensified into a small but violent typhoon, which inclined to the northwest, thus bringing the center to Hainan Island where it recurved to the northeast. It moved across the coast into the Continent where it disappeared during the afternoon and evening hours of July 10.

When this disturbance was crossing the Philippines, pressure values were between 755.0 mm and 756.5 mm (29.724 and 29.783 in.) with only slight indications of circulation. At Manila, the barograph trace during the early morning hours (2 to 5 a. m.) July 6, showed an irregular fall and rise of pressure. Compared with the traces on the days before and after, it was unusual inasmuch as it happened only that day. There was some rain accompanying this change of pressure; a wind shift from northeast to northwest and back to northeast (surface winds) occurred also, these events happening when the low pressure center was south of Manila. Barograph records from the provincial stations are not available at the time of writing; a later study of these may show the progress of the disturbance across the archipelago.

Observations from the S. S. *Conte Verde* gave first indications that the disturbance was intensifying. On July 7, 6 a. m. (Manila time) a pressure of 750.2 mm (29.535 in.) with east-northeast winds force 6, in latitude 16.0° N., longitude 113.1° E., was reported. July 8, 2 p. m., the recently established station on one of the Paracel Islands reported a pressure of 749.8 mm (29.520 in.), with south-southeast winds force 9.

Upper winds reported during the period of this storm indicate that two simultaneous surges occurred as it was crossing the Philippines. At Manila, the velocities of a southeasterly current increased from values of about 20 k. p. h. on July 5 to values between 30 and 60 k. p. h. on July 6, the velocities weakening the next day. No increase was shown at the other Philippine aerological stations. Malaya pilots received during this period also show an increase of values between 5 and 45 k. p. h. on July 4 to values between 25 and 60 k. p. h. on July 6, the direction being from the southwest quadrant. On July 7 the southwest current decreased, and on the 8th the direction changed to the east quadrant, according to the data available.

As the disturbance moved across the China Sea and approached the region of the Paracels, a southwesterly current was steadily flowing across Siam and Indio China. The proximity of the typhoon affected only the upper winds of Tourane, changing them to the northwest quadrant, no long ascents being reported and velocities between 10 and 25 k. p. h. recorded. On the 8th, the directions over Tourane changed to the northeast aloft, the typhoon being about 180 miles to the east and moving northwest. At the same time a surge seemed to have occurred over Bandon, Siam, and Saigon, Indo China. At Bandon,

velocities of 5 to 30 k. p. h. were reported on July 6 and 7, increasing to about 60 k. p. h. July 9, the directions being from the southwest quadrant. Saigon, Indo China, did not report every day, but the ascents available indicate that the southwest current surged over that region on its way to the storm center. All pilots on July 10 showed weakening velocities. These reports are indications of the way the velocities of the upper winds can be used for forecasting purposes.

Depression, July 14–21, 1938.—A mild depression, apparently of minor importance, formed about 400 miles south-southeast of Guam, moved in a west-northwesterly direction to a position about 300 miles east-northeast of San Bernardino Strait. From this location it moved in a northerly direction, filling up over the regions east of Balintang Channel.

Typhoon, July 16–23, 1938.—According to observations available at the time of preparing this account, this disturbance manifested the intensity of a typhoon for only 1 day, after traversing a course from the northern part of the Mariana Islands. As a weak depression or a low pressure area, it first moved north-northeast, inclined to the north, then north-northwest and again north, thus reaching the ocean regions east of central Japan. On July 22, the 0000 and 1200 GCT observations from the S. S. *Pres. Cleveland* showed that an active typhoon had formed. From latitude 35.0° N, longitude 146.8° E, south-southeast winds force 11, with pressure 750.8 mm (29.559 in.) were reported. This was the 1200 GCT observation. The preceding 0000 GCT observation had the same pressure value, but with winds of force 10 from the north in latitude 34.9° N, longitude 143.1° E. On July 23, it seemed that the center had weakened as it changed its course to the east-northeast.

Typhoon, July 17–19, 1938.—A low pressure area, central about 300 miles east of the southern coast of Indochina, quickly intensified into a typhoon during the afternoon hours of July 17. This small, but active center moved west-northwest to the coast, entering Indochina a short distance south of Tourane July 18. The next morning it was located about 120 miles northwest of Tourane, decreasing in strength so much that no trace of it could be found the same afternoon.

A study of the upper winds available at the time of writing this article does not bring out much evidence of any surges. The pilots from Indo China are not sufficient for deriving any conclusions. The west and southwest winds over Siam from July 12 to 16 had velocities ranging from 20 to 60 k. p. h. Bandon, however, had low values on July 13 and 14, and increased to values between 35 and 70 k. p. h. on July 17. These values were maintained until July 23. Pilots from the Straits Settlements indicated an increase of the southwest quadrant current velocities during the 4 days, July 12 to 15, first reporting values between 5 and 30 k. p. h. and then indicating values between 15 and 60 k. p. h. After July 17, the velocities weakened considerably. Over the Philippines, there was nothing worth mentioning except the data from Zamboanga. There, July 15 and 16, the velocities of the southwest winds increased to values of 70 k. p. h. and maintained them. There also was a tendency for the directions to veer to the northwest quadrant aloft. On July 18 and 19, the velocities decreased to values around 20 and 30 k. p. h. A comparison of these values with the velocities reported from Indo China (about 5 to 20 k. p. h. in the few pilots received) at places so much closer to the storm center is interesting, and shows the power of the southwest current of air over the China Sea.

CLIMATOLOGICAL TABLES

CONDENSED CLIMATOLOGICAL SUMMARY

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

TABLE 1.—*Condensed climatological summary of temperature and precipitation by sections, August 1938*

[For description of tables and charts, see REVIEW, January, p. 29]

Section	Temperature								Precipitation					
			Monthly extremes								Greatest monthly		Least monthly	
	Section average	Departure from the normal	Station	Highest	Date	Station	Lowest	Date	Section average	Departure from the normal	Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	81.6	+1.7	Tuscumbia	106	27	Florence	58	19	3.89	−0.64	Paint Rock	9.45	Cochrane	0.60
Arizona	78.6	+.1	Casa Grande	119	1	Alpine	30	18	2.24	−.10	Cibecue	7.76	Wikieup	.12
Arkansas	83.2	+3.1	2 stations	109	1 24	Gilbert	54	25	2.26	−1.29	Dumas	5.45	Boughton	.24
California	71.9	−.5	Cow Creek	125	1 1	Boca	35	1 9	.08	−.02	Seven Oaks	4.23	207 stations	.00
Colorado	68.5	+2.9	Sedgwick	112	2	Pearl	21	1 17	1.77	−.18	Leadville	5.87	Palisade	.06
Florida	82.2	+.8	2 stations	104	1 25	2 stations	61	1 5	3.82	−3.18	Federal Point	9.30	Davie	.35
Georgia	81.3	+1.8	4 stations	105	1 24	Blairsville	53	19	3.02	−2.19	Brunswick	8.79	Washington	.56
Idaho	65.4	−.9	3 stations	105	1 24	Obsidian (near)	23	14	.51	−.13	Tetonia	1.98	3 stations	.00
Illinois	77.7	+3.1	Sparta	106	23	2 stations	49	27	3.33	−.01	Freeport	8.53	La Salle	.54
Indiana	76.2	+2.7	Columbus	105	7	Wheatfield	47	25	3.21	−.17	Terre Haute	10.03	Scottsburg	.28
Iowa	75.7	+3.5	Knoxville	105	3	Spencer	42	26	3.82	+.27	Red Oak (near)	9.71	Sioux City	.59
Kansas	82.9	+5.1	2 stations	111	1 5	Tribune	48	21	2.53	−.57	Valley Falls	8.71	2 stations	T
Kentucky	78.0	+2.2	Quicksands	101	9	Winchester	52	26	4.45	+.74	Russellville	8.43	Cynthiana	1.33
Louisiana	82.5	+.6	Minden	105	1 26	Lake Providence	60	14	6.21	+1.12	Jennings	17.63	Plain Dealing	1.04
Maryland-Delaware	76.3	+3.0	Great Falls, Md	100	15	Oakland, Md	38	30	2.71	−1.88	Elkton, Md	6.17	Cambridge, Md	.50
Michigan	71.0	+4.2	Fife Lake	99	2	Dukes	31	30	4.29	+1.61	West Branch	8.86	Grand Marais	1.55
Minnesota	71.5	+3.9	Wheaton	106	13	Mizpah	34	29	2.59	−.59	Pigeon River Bridge	6.41	Mankato	.82
Mississippi	82.7	+1.9	Columbia	107	26	Pontotoc	61	2	3.96	−.28	D'Lo	9.11	Moorhead	.35
Missouri	81.1	+4.6	Garber	108	23	2 stations	53	1 12	2.62	−1.16	Lucerne	9.37	Crystal City	.03
Montana	65.0	+.2	2 stations	103	1 11	Wisdom	23	21	.92	−.19	Savage	3.79	Lonepine	.08
Nebraska	78.0	+4.7	Benkleman	113	2	Harrison	39	20	1.97	−.77	Waterloo	6.73	Genoa	.05
Nevada	71.3	+.7	Las Vegas Airport	116	1	2 stations	33	1 15	.42	−.08	Alamo	1.60	2 stations	.00
New England	70.3	+3.3	2 stations	99	3	Somerset, Vt	32	29	3.54	−.32	Cornwall, Vt	7.41	Provincetown, Mass	.46
New Jersey	75.4	+3.6	Flemington	100	15	Runyon	41	13	3.08	−1.67	Tuckerton	5.26	Somerville	1.24
New Mexico	71.9	+1.2	Carlsbad	107	20	2 stations	25	20	1.02	−1.41	Mogollon	4.46	4 stations	.00
New York	71.3	+3.7	4 stations	98	1 3	Wanakena	36	29	4.31	+.50	Cortland	8.77	Scio	1.56
North Carolina	77.8	+1.9	Fayetteville	102	17	Banners Elk	44	20	2.84	−2.65	Tapoco	9.34	Weldon	.44
North Dakota	69.8	+3.4	Edgeley	109	13	3 stations	33	1 19	1.50	−.50	Lisbon	5.22	Hettinger	.20
Ohio	74.9	+3.2	2 stations	97	1 10	2 stations	46	1 29	3.10	−.31	Zanesville	6.75	Greenville	.36
Oklahoma	84.4	+2.9	Hollis	110	10	Boise City	52	1 21	2.04	−.86	Perry	7.40	2 stations	.00
Oregon	63.5	−1.8	Nyssa	104	28	2 stations	21	1 2	.13	−.28	Zigzag	.87	32 stations	.00
Pennsylvania	73.8	+3.5	3 stations	100	1 14	Somerset	36	30	2.90	−1.33	Arendtsville	8.53	Smethport	.59
South Carolina	81.2	+2.4	6 stations	108	1 24	5 stations	59	1 19	2.27	−3.43	Caesars Head	8.00	Blairs	T
South Dakota	75.9	+5.0	Britton	114	13	Pollock	38	26	1.11	−1.00	Clear Lake	4.55	Camp Crook	.20
Tennessee	79.2	+2.5	Newbern	104	1 24	Rugby	50	19	4.22	+.21	Liberty	9.79	Memphis	.97
Texas	83.6	+.8	Seymour	103	10	Mount Locke	50	30	1.32	−.99	Bon Wier	7.33	5 stations	.00
Utah	70.4	+.6	St. George	109	1	Soldier Summit	25	16	1.09	+.04	Park City	4.52	Vernal	.00
Virginia	76.1	+2.0	Lincoln	101	1 15	2 stations	44	1 20	2.61	−1.75	Clifton Forge	7.59	Cheriton	.15
Washington	63.8	−1.8	Wahluke (near)	106	26	Deer Park (near)	26	22	.34	−.51	Paradise Inn	1.33	3 stations	.00
West Virginia	73.7	+1.9	Martinsburg	100	1 14	Bayard	35	30	2.58	−1.52	Wayne	7.03	Elk (Harrison Co.)	.78
Wisconsin	70.8	+3.2	Prentice	100	2	2 stations	35	1 25	4.95	+1.69	Beloit	9.38	Plum Island	.54
Wyoming	65.0	+1.1	2 stations	105	2	South Pass City	16	21	1.07	−.02	Foxpark	2.73	Nine Mile Creek	.03
Alaska (July)	55.5	.0	do	88	1 5	4 stations	31	1 10	2.91	+.33	Little Port Walter	12.98	Pilgrim Springs	.20
Hawaii	75.9	+.8	Mana	93	1 3	Kanalohuluhulu	48	3	7.47	+1.07	Wahiawa Water Intake	28.00	Mahukona	.15

[1] Other dates also.

TABLE 2.—*Climatological data for Weather Bureau stations, August 1938*

[Compiled by Agnes R. Thompson, by official authority U. S. Weather Bureau]

District and Station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground end of month
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	° *F.*	°*F.*	°*F.*		°*F.*	°*F.*		°*F.*	°*F.*	°*F.*	°*F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
New England							71.1	+3.7										79	3.06	−0.5											5.0		
Eastport	75	67	85	29.86	29.94	−0.02	63.3	+2.6	83	23	71	49	29	56	26	59	57	87	2.27	−0.7	13	7.8	s.	25	w.	3	6	12	13	6.1	0.0	0.0
Greenville, Maine	1,069	4	41	28.89	29.95	.....	65.8	.....	89	16	77	33	28	55	35	61	59		3.69	.....	16	.....	s.	.....	.....	.....	8	13	10	5.8	.0	.0
Portland, Maine	103	82	117	29.83	29.95	−.03	71.2	+4.8	92	16	79	50	29	63	25	63	60	74	1.69	−1.4	12	7.5	s.	24	s.	1	17	7	7	4.0	.0	.0
Concord	289	54	72	29.65	29.96	−.02	71.5	+4.7	94	4	83	45	29	60	33	.....	.....		2.58	−1.0	8	4.8	s.	20	nw.	24	13	14	4	4.1	.0	.0
Burlington	403	11	48	29.51	29.93	−.04	70.0	+2.1	91	15	80	45	29	61	31	64	61	75	3.66	+.3	14	7.4	s.	24	s.	31	7	13	11	5.8	.0	.0
Northfield	876	12	60	29.03	29.96	−.02	67.0	+3.6	91	4	79	38	29	55	39	62	60	84	3.78	+.2	11	6.3	s.	20	s.	1	10	10	11	5.4	.0	.0
Boston [1]	29	33	62	29.92	29.95	−.04	73.6	+3.7	94	15	82	56	29	65	24	66	63	75	3.31	−.3	12	8.6	w.	32	nw.	24	7	15	9	5.5	.0	.0
Nantucket	12	14	90	29.96	29.97	−.02	71.0	+3.2	86	3	77	56	29	65	18	67	65	86	3.02	−.4	6	12.0	sw.	27	nw.	24	12	9	10	5.0	.0	.0
Block Island	26	11	46	29.95	29.98	−.01	71.2	+2.7	89	16	77	60	26	65	17	67	66	87	5.27	+1.6	8	12.2	sw.	30	nw.	24	14	11	6	4.0	.0	.0
Providence	159	215	251	29.80	29.97	−.02	74.6	+3.6	95	3	83	55	29	66	26	67	64	74	2.21	−1.3	8	9.3	nw.	38	nw.	24	9	15	7	5.1	.0	.0
Hartford	159	66	100	29.79	29.96	−.03	74.2	+5.3	94	3	84	54	30	64	31	.....	.....		3.21	−1.1	7	6.9	s.	26	nw.	24	11	11	9	4.9	.0	.0
New Haven	106	74	153	29.86	29.97	−.02	74.4	+4.1	95	15	83	56	30	66	26	68	64	73	2.64	−1.6	8	7.5	s.	24	nw.	24	15	4	12	4.8	.0	.0
Middle Atlantic States							76.7	+3.3										74	3.11	−1.2										4.7		
Albany [1]	292	26	37	29.65	29.96	−.02	73.1	+2.3	95	15	85	45	29	61	38	66	63	75	3.18	−.5	13	7.4	s.	28	sw.	1	8	16	7	5.1	.0	.0
Binghamton	871	57	79	29.09	30.00	+.01	72.8	+4.8	95	3	85	49	29	60	33	64	61	76	3.83	+.2	11	5.6	nw.	21	nw.	11	4	13	14	6.5	.0	.0
New York	314	415	454	29.65	29.97	−.03	76.3	+3.2	93	15	84	60	25	68	22	68	64	73	1.99	−2.3	8	12.2	sw.	41	nw.	24	11	12	8	4.9	.0	.0
Harrisburg	374	94	104	29.60	29.99	−.02	77.2	+4.6	95	15	87	57	26	67	27	68	64	68	4.28	+.2	7	5.8	w.	25	nw.	10	13	14	4	3.9	.0	.0
Philadelphia	114	174	367	29.88	30.00	.00	78.4	+3.6	95	16	86	63	26	70	22	69	65	70	4.10	−.3	12	10.8	sw.	33	s.	31	12	10	9	4.6	.0	.0
Reading	323	283	306	29.65	29.99	−.01	77.1	+4.7	95	15	86	57	26	68	26	68	65	70	2.58	−1.6	8	8.1	nw.	38	se.	17	13	14	4	4.0	.0	.0
Scranton	805	72	104	29.14	29.99	−.01	73.6	+3.8	93	17	85	53	26	62	29	65	61	69	1.62	−2.1	9	5.7	n.	22	nw.	24	10	16	5	4.5	.0	.0
Atlantic City	52	37	172	29.94	29.99	−.01	75.0	+2.5	95	16	82	60	26	68	23	69	67	80	3.91	−.6	7	13.4	s.	32	s.	1	12	11	8	4.6	.0	.0
Sandy Hook	22	10	55	29.95	29.97	.....	76.4	+3.9	93	15	83	64	26	70	20	66	67	79	3.56	−1.4	11	10.9	sw.	33	nw.	6	13	7	11	4.8	.0	.0
Trenton	190	86	107	29.79	29.98	.....	76.6	+3.6	95	15	86	59	25	67	27	69	66	75	3.66	−1.1	10	7.5	s.	26	s.	5	11	11	9	5.2	.0	.0
Baltimore	123	100	215	29.87	29.99	−.02	80.0	+4.5	98	15	89	61	26	71	24	70	66	67	2.43	−1.9	10	9.0	sw.	32	s.	31	12	11	8	4.9	.0	.0
Washington	112	62	85	29.88	30.00	−.01	78.6	+3.6	96	15	88	60	25	69	26	70	67	73	4.64	+.6	5	5.2	sw.	17	nw.	24	12	12	7	4.7	.0	.0
Cape Henry	18	8	54	30.00	30.02	.....	78.4	+1.5	93	11	86	62	26	71	26	73	71	80	2.23	−2.6	8	9.2	sw.	57	nw.	11	12	13		4.3	.0	.0
Lynchburg	686	144	184	29.32	30.05	+.03	78.3	+2.7	96	16	89	58	26	67	30	70	66	73	3.24	−.5	7	5.6	nw.	25	nw.	17	12	11	8	4.8	.0	.0
Norfolk	91	80	125	29.93	30.02	+.02	80.4	+3.0	97	15	88	66	26	72	26	72	69	74	2.78	−2.4	8	7.9	sw.	35	nw.	11	11	12	8	5.2	.0	.0
Richmond	144	11	52	29.88	30.03	+.02	79.0	+2.5	95	15	89	58	26	69	28	71	68	78	2.44	−2.0	6	6.5	sw.	18	sw.	31	15	12	4	3.8	.0	.0
Wytheville	2,304	49	55	27.73	30.08	+.07	72.0	+1.5	88	15	83	53	26	61	29	65	63	79	2.44	−1.8	10	5.0	w.	16	w.	11	11	16	4	4.7	.0	.0
South Atlantic States							81.2	+3.0										77	3.05	−2.6										4.5		
Asheville	2,253	89	104	27.79	30.07	+.05	75.1	+4.6	93	16	86	56	19	64	30	67	65	83	2.67	−1.5	14	6.0	nw.	24	nw.	17	5	17	9	5.9	.0	.0
Charlotte	779	63	86	29.23	30.05	+.03	80.2	+3.1	97	16	90	63	20	70	30	71	67	71	2.58	−2.5	10	6.2	sw.	30	nw.	24	8	18	5	4.9	.0	.0
Greensboro [1]	886	5	76	29.13	30.07	.....	78.2	.....	96	15	89	59	20	67	29	70	67	78	1.65	.....	10	6.4	sw.	26	nw	17	10	16	5	4.9	.0	.0
Hatteras	11	6	50	30.03	30.04	+.04	80.0	+2.0	91	10	86	65	26	77	18	74	72	81	.85	−4.9	7	11.5	sw.	26	sw.	7	13	15	3	3.9	.0	.0
Raleigh	376	103	140	29.64	30.02	+.01	80.7	+3.7	98	16	91	65	20	71	26	71	68	73	1.31	−4.1	9	7.5	sw.	22	sw.	2	15	16	0	3.7	.0	.0
Wilmington	72	73	107	29.98	30.04	+.04	80.7	+3.1	96	17	89	67	31	73	24	74	72	81	5.84	−.5	9	8.2	sw.	26	sw.	17	16	12	3	3.9	.0	.0
Charleston	48	11	92	30.01	30.06	+.05	83.0	+2.0	99	24	90	72	5	76	23	76	73	78	3.60	−2.9	7	8.9	s.	25	n.	27	7	15	9	5.3	.0	.0
Columbia, S. C.	347	70	91	29.69	30.06	+.05	82.4	+2.8	100	24	92	67	31	72	28	72	69	73	.91	−4.6	11	7.3	s.	30	sw.	1	17	13	1	3.4	.0	.0
Greenville, S. C.	1,039	139	.....	28.97	30.04	.....	80.0	+4.2	100	24	90	66	21	70	30	70	67	71	3.01	−2.5	11	5.8	ne.	27	nw.	4	9	12	10	5.5	.0	.0
Augusta	182	62	77	29.84	30.03	+.02	83.2	+2.8	101	24	93	70	31	73	28	74	71	74	1.86	−3.2	8	5.1	s.	26	sw.	1	15	10	6	4.3	.0	.0
Savannah	65	73	152	29.98	30.05	+.04	84.4	+3.7	102	27	94	72	17	75	27	74	72	78	1.81	−5.5	6	9.2	sw.	32	e.	14	13	13	5	4.3	.0	.0
Jacksonville	43	86	110	30.02	30.07	+.06	83.0	+1.3	98	27	92	69	6	74	23	74	72	78	9.15	+3.3	9	6.7	s.	25	s.	1	16	10	5	4.4	.0	.0
Florida Peninsula							82.9	+0.9										76	1.36	−5.0										4.9		
Key West	21	10	64	29.99	30.01	+.03	83.8	+.3	90	19	89	71	10	79	17	76	74	76	2.16	−2.4	11	10.5	e.	28	e.	10	12	13	6	4.6	.0	.0
Miami	25	124	168	30.02	30.05	+.03	83.2	+1.8	90	18	87	73	4	79	16	76	73	73	1.15	−5.0	5	8.9	e.	25	e.	10	11	16	4	4.4	.0	.0
Tampa	35	88	197	30.03	30.06	+.06	83.1	+1.6	95	29	92	70	7	74	20	75	72	78	.78	−7.4	7	8.5	e.	32	s.	7	9	19	3	4.9	.0	.0
Titusville	43	5	36	.....	.....	.....	81.4	.0	99	27	92	65	17	71	29	74	73	.....	1.34	−5.2	4	.....	se.	.....	.....	.....	6	16	9	5.8	.0	.0
East Gulf States							82.4	+2.4										76	3.18	−2.1										4.9		
Atlanta [1]	976	5	53	29.05	30.04	+.03	81.2	+4.2	99	25	92	66	21	71	29	72	69	75	1.83	−2.6	8	7.2	nw.	31	nw.	28	8	14	9	5.2	.0	.0
Macon	370	79	87	29.66	30.05	+.04	82.3	+2.4	102	25	92	69	27	72	31	74	70	73	3.26	−1.1	9	5.7	nw.	26	n.	27	11	12	8	4.9	.0	.0
Thomasville	273	49	58	.....	.....	.....	82.4	+1.4	101	25	93	69	15	72	27	74	72	.....	3.03	−2.7	11	.....	e.	.....	.....	.....	12	14	5	.....	.0	.0
Apalachicola	35	11	.....	30.02	30.06	.....	82.6	+1.4	96	18	89	69	28	76	22	76	74	79	5.23	−2.3	7	6.6	s.	37	ne.	28	12	7	12	5.0	.0	.0
Pensacola	56	149	185	30.00	30.05	+.07	82.2	+1.3	95	26	88	70	7	76	21	75	72	75	4.11	−3.9	11	9.9	s.	40	se.	26	15	10	6	4.2	.0	.0
Anniston	741	9	.....	.....	.....	.....	80.0	+3.6	99	25	90	63	19	70	32	.....	.....		2.24	−1.8	9	.....	w.	.....	.....	.....	22	5	4	.....	.0	.0
Birmingham	700	11	48	29.32	30.05	+.06	81.8	+2.6	103	27	92	65	19	72	31	72	69	76	2.61	−1.6	9	5.3	s.	18	s.	14	12	10	9	4.6	.0	.0
Mobile	57	86	161	29.98	30.04	+.06	83.4	+2.4	100	26	92	69	5	75	25	74	72	76	2.04	−4.9	6	7.8	s.	41	se.	26	11	12	8	5.3	.0	.0
Montgomery	218	92	105	29.82	30.06	+.07	83.0	+2.2	102	25	92	68	29	74	27	74	71	74	3.08	−1.2	9	5.5	w.	31	ne.	28	15	8	8	4.4	.0	.0
Meridian	375	67	92	29.66	30.04	+.06	82.6	+3.1	101	25	93	68	20	72	26	73	71	78	3.66	−.9	11	4.1	s.	23	se.	28	12	11	8	5.0	.0	.0
Vicksburg	247	82	102	29.78	30.04	+.06	82.8	+2.0	96	25	91	68	31	74	26	74	72	77	3.74	−.3	6	6.5	sw.	26	n.	31	12	11	8	5.9	.0	.0
New Orleans	53	76	84	29.99	30.04	+.06	84.6	+2.4	100	26	92	71	8	77	20	76	73	76	3.35	−2.4	10	5.7	se.	21	ne.	23	11	9	11	5.4	.0	.0
West Gulf States							84.3	+2.3										71	2.49	−0.7										4.0		
Shreveport	249	92	227	29.76	30.02	+.05	85.0	+3.0	101	31	95	71	13	75	25	74	71	71	2.05	−.6	7	8.3	s.	48	ne.	27	17	10	4	3.7	.0	.0
Bentonville	1,303	12	38	28.63	29.96	−.01	81.7	+5.2	99	25	94	63	1	70	35	.....	.....		2.50	−1.6	4	4.7	s.	18	s.	16	22	7	2	.....	.0	.0
Fort Smith	463	57	82	29.54	30.01	+.04	85.6	+5.1	101	26	97	69	16	74	27	73	69	66	3.03	−.2	4	6.1	e.	21	w.	10	16	14	1	3.3	.0	.0
Little Rock	357	94	102	29.64	30.01	+.03	84.0	+4.2	102	25	94	70	17	74	26	73	69	70	3.46	−.3	5	7.0	sw.	30	n.	11	15	13	3	3.7	.0	.0
Austin	605	68	90	29.36	29.99	.....	84.8	+1.0	99	15	95	71	25	74	26	74	69	68	.63	−1.4	1	6.7	s.	25	se.	27	19	10	2	3.4	.0	.0
Brownsville	57	88	96	29.89	29.95	.....	83.9	.0	95	13	91	71	25	76	20	76	73	79	5.65	+3.1	6	10.0	se.	30	ne.	27	14	13	4	4.6	.0	.0
Corpus Christi	20	11	78	29.96	29.98	+.05	84.6	+2.1	93	15	90	73	27	79	16	77	75	79	4.51	+2.2	3	10.8	se.	31	ne.	28	18	10	3	3.4	.0	.0
Dallas	512	220	227	29.45	29.98	.....	85.6	.....	99	24	95	73	5	76	22	72	65	58	.31	−2.5	2	9.7	se.	30	s.	16	19	8	4	3.5	.0	.0
Fort Worth	679	92	110	29.30	30.00	+.06	85.9	+2.9	100	24	96	73	11	76	26	.....	.....		.11	−2.5	1	9.1	s.	28	s.	16	24	6	1	1.7	.0	.0
Galveston	54	106	114	29.96	30.02	+.06	84.0	+1.0	92	24	88	70	27	80	19	76	74	75	6.03	+1.8	9	9.3	s.	38	se.	27	11	15	5	4.8	.0	.0
Houston	138	292	314	29.88	30.02	.....	83.6	+.4	96	25	92	72	1	76	21	.....	.....		1.66	−2.5	7	9.1	s.	35	se.	27	4	17	10	6.0	.0	.0
ales tine	510	64	72	29.50	30.02	+.05	83.4	+1.6	98	30	93	70	9	74	24	73	69	72	1.67	−.5	4	6.0	s.	21	s.	3	20	8	3	3.3	.0	.0
Port Arthur	34	59	134	29.99	30.03	.....	84.1	.....	97	26	91	73	1	77	21	76	73	76	2.89	−3.1	13	9.6	s.	34	se.	14	12	11	8	5.2	.0	.0
San Antonio	693	111	301	29.28	29.98	+.05	84.6	+1.1	100	15	95	70	25	75	24	73	68	67	.44	−2.0	3	10.5	se.	35	e.	24	8	19	4	4.7	.0	.0

[1] Observations taken at airport.

TABLE 2.—*Climatological data for Weather Bureau stations, August 1938*—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
Ohio Valley and Tennessee	*Ft.*	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
							77.7	+2.7										74	3.15	−0.3											4.7		
Chattanooga	762	71	214	29.25	30.04	+0.04	81.2	+3.7	97	26	91	66	20	71	28	72	69	73	2.40	−1.6	11	6.8	w.	36	n.	27	11	15	5	4.9	0.0	0.0
Knoxville	995	66	84	29.02	30.05	+.04	79.5	+3.3	95	24	90	62	19	69	28	71	68	75	2.19	−1.7	13	4.8	w.	18	n.	17	15	13	3	3.9	.0	.0
Memphis	399	78	86	29.60	30.02	+.04	84.2	+4.8	100	26	92	72	17	76	22	74	71	71	.97	−2.4	6	6.7	sw.	26	sw.	15	11	16	4	4.2	.0	.0
Nashville	546	168	188	29.49	30.06	+.06	80.4	+2.6	96	26	90	64	20	71	27	72	70	76	2.38	−1.3	10	6.3	w.	33	ne.	31	8	18	5	4.7	.0	.0
Lexington	989	6					77.5	+3.0	96	8	89	58	29	66	33				3.70	+.2	11		sw.				17	10	4		.0	.0
Louisville	525	188	234	29.48	30.05	+.05	78.4	+1.4	93	9	88	64	18	69	25	71	68	77	3.79	+.4	11	7.7	s.	35	n.	4	13	13	5	4.3	.0	.0
Evansville	431	76	116	29.57	30.02	+.03	79.8	+2.4	98	23	89	63	18	71	26	72	68	74	4.11	+.8	8	6.8	s.	36	n.	8	13	9	9	4.7	.0	.0
Indianapolis	822	194	230	29.17	30.04	+.04	77.0	+3.3	94	9	86	56	25	68	27	68	64	68	2.53	−.8	10	8.2	s.	29	w.	11	9	15	7	5.1	.0	.0
Terre Haute	575	63	149	29.40	30.01		79.0		97	9	90	60	25	68	27	70	66	71	10.03	+6.8	8	7.5	s.	29	n.	5	10	14	7	4.7	.0	.0
Cincinnati	627	11	51	29.38	30.04	+.03	76.2	+2.6	92	7	86	58	29	66	28	68	66	79	4.02	+.6	10	5.3	sw.	21	nw.	4	11	12	8	4.6	.0	.0
Columbus	822	90	210	29.18	30.03	+.02	76.8	+3.8	93	10	87	57	25	67	28	68	64	71	3.32	+.1	5	7.4	s.	31	n.	11	7	19	5	4.9	.0	.0
Dayton	900	186	213	29.10	30.03		75.6	+2.2	91	10	85	56	25	66	27	68	64	71	1.63	−1.6	9	7.2	sw.	29	sw.	6	13	12	6	4.5	.0	.0
Elkins	1,947	65	83	28.08	30.09	+.07	70.8	+1.7	89	16	83	47	30	59	36	64	62	84	1.39	−2.5	10	4.5	nw.	23	w.	17	7	16	8	5.5	.0	.0
Parkersburg	637	77	84	29.37	30.04	+.03	75.6	+1.7	92	10	86	55	30	65	31	68	65	76	1.97	−1.5	7	4.9	se.	22	n.	4	13	13	5	4.5	.0	.0
Pittsburgh [1]	1,273	39	54	28.70	30.03	+.02	74.7	+1.8	94	16	86	54	29	64	30	66	61	70	2.86	−.4	9	8.1	sw.	36	w.	17	10	15	6	5.1	.0	.0
Lower Lake Region							74.0	+4.3										70	2.89	−0.2										4.8		
Buffalo	768	243	280	29.18	29.99	.00	72.3	+3.7	90	16	78	56	31	66	22	66	63	75	3.24	+.2	9	13.3	sw.	47	nw.	10	11	13	7	4.7	.0	.0
Canton	448	10	61	29.48	29.94		70.6	+2.8	91	15	81	43	28	60	32	64	61	75	3.55	−.1	13	7.3	sw.	33	w.	1	7	14	10	5.8	.0	.0
Ithaca	836	77	100	29.10	29.98		73.2	+4.6	96	3	85	48	26	61	37	65	61	68	3.56	+.2	8	7.2	nw.	21	nw.	24	6	16	9	6.1	.0	.0
Oswego	335	71	85	29.60	29.96	−.03	72.2	+3.8	93	4	81	50	31	64	33	66	62	74	2.72	+.1	10	7.6	s.	22	n.	23	7	15	9	5.6	.0	.0
Rochester	523	86	102	29.43	29.99	.00	73.6	+4.4	93	3	82	53	26	65	29	65	61	68	4.85	+2.0	9	8.2	sw.	25	sw.	1	10	16	5	4.6	.0	.0
Syracuse	596	65	79	29.36	30.00	+.01	74.2	+5.4	96	4	83	51	29	65	30				5.05	+2.2	12	6.7	s.	20	w.	11	8	15	8	5.3	.0	.0
Erie	714	130	81	29.25	30.00	−.01	75.0	+5.4	94	16	83	56	26	67	26	67	63	72	3.68	+.4	9	7.2	sw.	21	sw.	6	16	12	3	3.5	.0	.0
Cleveland	762	267	318	29.21	30.01	.00	75.0	+5.0	90	15	82	59	26	68	21	66	62	67	.81	−2.0	6	11.9	s.	45	nw.	10	13	13	5	4.0	.0	.0
Sandusky	629	5	67	29.35	30.02	+.01	76.0	+4.2	94	6	86	57	26	66	29				1.66	−1.5	5	7.3	sw.	21	nw.	6	10	12	9	5.0	.0	.0
Toledo	628	79	87	29.36	30.03	+.03	75.8	+4.5	93	9	85	56	25	67	25	67	62	67	.86	−2.0	6	8.3	sw.	28	w.	10	17	13	1	3.4	.0	.0
Fort Wayne	857	69	84	29.12	30.03		75.2	+3.5	92	10	85	56	25	65	29	67	63	69	2.14	−1.0	9	7.5	nw.	28	nw.	10	9	19	3	4.8	.0	.0
Detroit	626	5	78	29.34	30.00	−.01	74.8	+4.5	92	14	85	55	25	65	27	67	63	70	2.48	−.3	5	8.5	nw.	29	sw.	10	10	14	7	4.9	.0	.0
Upper Lake Region							71.1	+4.7										76	4.63	+1.1										4.8		
Alpena	609	13	89	29.32	29.98	−.02	71.4	+7.3	98	3	81	48	28	62	32	64	60	74	5.23	+2.4	10	10.1	nw.	28	nw.	23	12	15	4	4.4	.0	.0
Escanaba	612	41	49	29.32	29.97	−.02	68.2	+3.9	88	4	77	41	30	60	27	63	60	78	4.89	+1.7	9	10.6	s.	41	ne.	1	11	10	10	5.5	.0	.0
Grand Rapids	707	70	244	29.25	30.00	.00	74.4	+4.7	94	3	84	52	25	65	25	67	63	75	3.87	+1.3	8	9.4	sw.	36	nw.	20	11	14	6	4.9	.0	.0
Lansing	878	5	90	29.08	30.00		72.2	+3.7	91	3	82	51	25	62	31	66	64	79	4.24	+1.4	8	7.1	nw.	20	w.	10	12	13	6	4.7	.0	.0
Marquette	734	44	69	29.16	29.95	−.03	68.7	+4.9	95	14	77	43	30	60	26	62	58	72	4.72	+2.0	11	8.4	sw.	29	sw.	22	7	16	8	5.5	.0	.0
Sault Sainte Marie	614	11	52	29.30	29.98	−.01	67.0	+4.9	90	14	76	45	28	58	36	61	58	80	3.49	+.9	16	6.9	nw.	22	sw.	14	7	13	11	5.6	.0	.0
Chicago	673	7	131	29.30	30.01	+.01	75.0	+3.4	95	10	82	59	27	68	26	68	65	76	2.12	−1.1	9	8.4	sw.	28	sw.	16	15	12	4	4.2	.0	.0
Green Bay	617	109	141	29.32	29.98	−.01	72.4	+4.7	95	2	82	48	30	63	29	65	61	72	3.75	+.6	9	10.2	s.	37	ne.	16	12	10	9	4.8	.0	.0
Milwaukee	681	97	221	29.26	29.99	−.01	73.4	+4.2	94	2	82	56	25	65	24	66	63	74	6.47	+3.8	9	11.3	sw.	38	n.	20	18	6	7	4.2	.0	.0
Duluth	1,133	5	47	28.72	29.91	−.06	68.0	+5.4	93	14	78	50	26	58	32	61	57	75	1.56	−1.6	7	11.3	w.	31	sw.	14	13	12	6	4.3	.0	.0
North Dakota							70.5	+4.6										57	1.62	−0.6										3.2		
Moorhead, Minn	940	50	58	28.89	29.88	−.08	72.5	+6.4	99	13	86	48	26	59	38	61	53	58	2.59	−.3	6	8.4	s.	23	se.	7	17	12	2	3.6	.0	.0
Bismarck	1,674	8	57	28.14	29.88	−.06	71.4	+4.1	101	12	86	42	26	56	45	58	48	52	.84	−1.0	8	8.8	nw.	34	nw.	2	17	11	3	3.3	.0	.0
Devils Lake	1,478	11	44	28.34	29.88	−.06	69.1	+4.3	93	2	84	42	24	55	37	58	50	59	1.74	−.7	8	8.8	sw.	26	se.	2	18	8	5	3.5	.0	.0
Grand Forks	833	12	67				71.3	+5.9	95	12	85	42	29	58	43	60	53		1.22	−1.4	10	8.8	sw.				11	18	2		.0	.0
Williston	1,878	42	50	27.95	29.89	−.04	68.3	+2.2	95	12	83	46	25	54	43	56	49	58	1.70	+.2	7	7.2	w.	29	nw.	19	23	5	3	2.4	.0	.0
Upper Mississippi Valley							76.8	+4.0										73	3.21	−0.1										4.0		
Minneapolis-St. Paul, Minn	846	32	61	29.04	29.93	−.04	73.8	+3.9	95	2	85	51	26	63	33	65	60	68	3.45	+.3	10	10.2	s.	42	n.	22	14	12	5	4.2	.0	.0
La Crosse	714	11	48	29.22	29.98	−.02	73.2	+3.2	93	14	83	53	26	63	30	67	64	78	5.14	+1.4	10	8.0	s.	18	w.	14	15	7	9	4.3	.0	.0
Madison	974	70	78	28.96	29.98	−.01	72.8	+3.0	92	3	81	57	27	64	23	67	64	77	4.36	+1.2	9	7.2	s.	24	nw.	23	14	8	9	4.6	.0	.0
Charles City	1,015	10	51	28.92	29.98	+.01	72.7	+3.6	92	9	84	51	27	62	31	66	63	76	2.94	−.5	7	6.0	se.	21	se.	5	17	8	6	3.4	.0	.0
Davenport	606	66	161	29.35	30.00	+.02	77.4	+4.3	96	10	87	58	27	68	25	69	65	71	2.98	−.5	6	8.6	s.	31	nw.	20	15	8	8	4.1	.0	.0
Des Moines	861	5	99	29.07	29.96	−.01	77.6	+4.5	101	5	88	58	27	67	34	68	64	69	3.08	−.4	7	8.6	s.	30	s.	19	14	10	7	3.9	.0	.0
Dubuque	699	60	79	29.25	29.98	.00	75.0	+3.3	93	3	85	55	27	65	26	68	65	75	6.10	+2.9	7	5.4	s.	17	se.	5	13	9	9	4.5	.0	.0
Keokuk	614	64	78	29.34	29.98	.00	79.5	+4.5	99	10	90	61	25	69	30	70	66	68	2.30	−.9	7	7.1	sw.	29	sw.	6	16	7	8	3.6	.0	.0
Cairo	358	87	93	29.64	30.01	+.02	81.2	+3.4	98	26	90	66	18	72	24	74	72	80	1.56	−1.5	5	6.5	s.	28	sw.	14	11	11	9	5.2	.0	.0
Peoria	609	11	45	29.36	30.02	+.03	77.2	+4.7	97	10	88	55	27	67	27	69	66	75	3.01	−.1	7	5.3	s.	18	sw.	16	21	8	2	2.7	.0	.0
Springfield, Ill	656	5	191	29.34	30.00	+.01	79.4	+4.9	100	10	90	60	25	69	29	70	66	70	2.49	−.7	11	9.8	s.	37	nw.	5	13	10	8	4.4	.0	.0
St. Louis	568	179	303	29.40	30.00	+.01	81.8	+4.3	100	23	91	64	28	72	25	71	67	66	1.15	−1.8	9	10.3	s.	30	sw.	15	18	10	3	3.1	.0	.0
Missouri Valley							80.2	+6.2										60	2.93	−0.5										3.4		
Columbia, Mo	784	6	66	29.17	29.98	+.01	81.3	+5.7	101	10	92	63	27	70	29				1.77	−1.8	8	7.5	s.	32	nw.	20	18	11	2	3.5	.0	.0
Kansas City [1]	750	32	45	29.17	29.95	−.02	83.0	+6.4	103	10	94	63	27	72	32	71	66	64	6.78	+2.7	9	9.6	sw.	57	nw.	20	15	12	4	3.3	.0	.0
St. Joseph	967	11	49	28.95	29.94		80.8		100	5	92	61	12	70	31	70	66	67	6.85	+3.0	10	8.0	s.	22	e.	6	19	7	5	3.2	.0	.0
Springfield, Mo	1,324	98	104	28.63	29.99	+.02	83.5	+7.8	100	24	95	65	1	72	32	70	65	62	.55	−3.5	6	7.7	s.	18	sw.	19	22	4	5	3.1	.0	.0
Topeka	987	65	87	28.92	29.94		83.9	+7.7	104	7	96	64	12	72	32	70	65	62	2.15	−1.9	6	9.8	s.	24	e.	6	20	9	2	2.9	.0	.0
Lincoln	1,189	11	81	28.69	29.92	−.03	80.2	+5.8	103	5	92	57	21	69	35	68	62	61	4.63	+1.1	10	9.9	s.	43	n.	30	15	9	7	4.0	.0	.0
Omaha [1]	982	31	44	28.91	29.93	−.03	78.4	+4.0	103	5	89	57	21	68	35	69	65	68	3.99	+.9	10	9.7	s.	43	sw.	7	14	12	5	4.4	.0	.0
Valentine	2,598	47	54	27.26	29.91	−.03	76.5	+4.8	108	2	91	50	26	62	41	61	52	49	1.37	−.8	6	9.1	s.	29	w.	2	20	8	3	3.1	.0	.0
Sioux City	1,138	64	106	28.73	29.91	−.04	78.1	+6.1	102	23	90	50	26	66	36	66	60	58	.59	−2.5	6	9.1	s.	28	se.	18	16	9	6	3.9	.0	.0
Huron	1,307	59	74	28.54	29.90	−.05	77.4	+8.0	106	2	92	51	21	63	41	62	53	50	.63	−1.8	6	9.8	s.	32	nw.	6	21	10	0	2.9	.0	.0
Northern Slope							68.6	+2.5										59	1.04	−0.2										3.9		
Havre	2,507	11	67	27.24	29.93	+.02	67.3	+1.9	95	11	82	43	20	52	45	53	43	50	1.40	+.2	11	7.9	w.	29	w.	17	17	8	6	3.9	.0	.0
Helena	4,124	85	111	25.83	29.94	.00	66.1	+1.1	93	11	79	42	20	53	37	52	40	44	1.24	+.5	6	8.0	sw.	22	s.	17	13	13	5	4.3	.0	.0
Missoula	3,263	89	91				67.5	+1.9	93	27	83	42	20	52	39				.63	−.3	9	6.8	nw.	29	w.	1	16	9	6	3.8	.0	.0
Kalispell	2,973	48	56	26.94	29.94	+.01	64.4	+1.6	90	31	79	39	20	49	38	51	41	50	.55	−.3	7	6.2	nw.	20	w.	21	16	6	9	4.3	.0	.0
Miles City	2,371	48	55	27.45	29.88	−.05	72.8	+1.3	101	11	87	47	20	58	41	56	44	43	.95	−.1	7	5.9	ne.	31	nw.	2	19	9	3	3.1	.0	.0
Rapid City	3,259	50	58	26.62	29.89	−.04	75.4	+5.0	102	12	89	50	20	60	41	58	47	44	.66	−1.0	7	7.6	w.	24	ne.	29	19	12	0	2.9	.0	.0
Cheyenne [1]	6,144	5	39	24.06	29.94	+.02	68.6	+3.0	96	1	84	41	20	54	44	54	46	55	2.26	+.7	13	9.7	w.	35	nw.	19	9	16	6	4.8	.0	.0
Lander	5,352	60	68	24.72	29.92	.00	66.8	+1.3	93	7	83	40	16	51	46	51	38	43	.56	.0	9	5.9	sw.	34	sw.	18	13	8	5	3.8	.0	.0
Sheridan	3,790	10	47	26.11	29.95		68.0		101	12	86	41	21	50	52	54	45	56	.30	−.6	3	4.5	nw.	21	w.	18	17	10	4	3.4	.0	.0
Yellowstone Park	6,241	12	46	24.00	30.06	+.13	59.3	+.2	83	11	74	33	15	45	39	48	39	57	1.07	−.2	13	7.4	sw.	29	sw.	22	14	10	7	4.5	.0	.0
North Platte	2,821	11	51	27.06	29.90	−.04	78.2	+7.4	106	23	92	55	21	65	42	64	56	54	1.80	−.6	6	7.3	s.	24	n.	15	14	11	6	4.3	.0	.0

[1] Observations taken at airport.

TABLE 2.—*Climatological data for Weather Bureau stations, August 1938*—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
Middle Slope							**81.1**	**+5.2**										**52**	**2.68**	**+0.2**										**2.8**		
Denver	5,292	106	113	24.81	29.94	+0.02	74.6	+3.9	100	1	86	55	20	63	36	57	46	44	0.96	−0.5	8	7.6	s.	28	se.	27	11	14	6	4.5	.0	.0
Pueblo	4,685	80	86	25.34	29.90	−.01	76.8	+4.1	103	1	91	54	21	63	40	60	49	46	2.03	+.2	5	7.3	nw.	24	w.	2	13	15	3	3.9	.0	.0
Concordia	1,392	50	58	28.48	29.91	−.04	82.0	+5.5	104	5	94	63	12	70	32	69	63	60	3.70	+.8	3	9.4	s.	24	nw.	14	18	12	1	2.8	.0	.0
Dodge City	2,509	10	86	27.37	29.89	−.04	83.6	+5.9	103	19	96	60	21	71	36	65	56	48	2.96	+.3	5	12.8	s.	33	s.	17	25	5	1	1.9	.0	.0
Wichita	1,358	85	93	28.53	29.92	−.03	84.2	+5.9	103	10	95	66	15	74	26	69	62	54	5.60	+2.5	4	10.9	s.	28	s.	29	26	4	1	1.5	.0	.0
Oklahoma City	1,214	10	47	28.70	29.94	.00	85.4	+5.7	101	25	97	68	16	74	27	70	64	57	.84	−2.0	2	9.0	s.	21	n.	15	21	9	1	2.5	.0	.0
Southern Slope							**82.3**	**+2.6**										**51**	**0.26**	**−2.0**										**2.6**		
Abilene	1,738	10	56	28.20	29.95	+.03	84.4	+2.4	100	15	95	69	25	73	28	69	62	54	.04	−2.2	1	9.1	s.	25	s.	15	20	8	3	2.9	.0	.0
Amarillo	3,676	10	49	26.31	29.93	+.01	81.6	+5.9	102	19	95	61	30	69	32	63	53	45	.15	−2.9	2	9.6	s.	23	ne.	11	23	7	1	2.5	.0	.0
Del Rio	960	63	71	28.95	29.92	+.02	84.5	+.3	98	14	94	68	29	76	23	71	65	58	.37	−1.4	2	9.9	se.	23	e.	28	20	8	3	2.8	.0	.0
Roswell	3,566	75	85	26.40	29.92	+.04	78.6	+2.0	102	20	92	60	25	66	35	62	53	47	.48	−1.7	4	7.8	s.	26	nw.	15	22	8	1	2.1	.0	.0
Southern Plateau							**78.3**	**+1.3**										**45**	**0.92**	**−0.3**										**3.2**		
El Paso	3,778	82	101	26.20	29.87	+.03	81.0	+1.8	100	20	93	62	31	69	29	63	52	42	.20	−1.5	3	8.1	e.	27	e.	29	22	9	0	2.1	.0	.0
Albuquerque [1]	4,972	5	39	25.11	29.86	------	76.7	+2.8	101	1	92	55	20	61	39	58	47	42	.16	−1.1	3	7.9	s.	35	s.	17	19	10	2	3.3	.0	.0
Santa Fe	7,013	38	53	23.39	29.95	+.06	70.2	+2.8	92	2	83	50	16	57	34	53	43	46	1.81	−.5	3	5.7	e.	20	n.	3	8	19	4	4.8	.0	.0
Flagstaff	6,907	10	59	23.48	29.89	+.05	64.4	+1.6	92	1	79	37	18	50	42	52	----	59	2.87	+1.1	15	7.3	n.	27	se.	24	3	14	14	----	.0	.0
Phoenix	1,107	39	51	28.68	29.79	.00	89.9	+.4	111	1	103	67	18	77	36	68	56	38	1.11	+.2	6	6.4	e.	32	se.	23	16	15	0	3.2	.0	.0
Yuma	141	9	54	29.64	29.78	+.02	90.4	.0	112	21	105	61	15	76	39	71	61	42	.25	−.2	4	5.4	s.	24	se.	3	19	11	1	2.5	.0	.0
Independence	3,957	5	26	------	------	------	75.8	.0	1	011	91	52	19	61	41	56	40	----	.03	−.1	1	------	s.	----	------	----	24	5	2	----	.0	.0
Middle Plateau							**71.7**	**+1.1**										**38**	**0.62**	**−0.1**										**2.9**		
Reno	4,527	61	76	25.50	29.94	+.10	70.8	+2.1	93	6	87	47	14	54	40	53	40	38	T	−.2	0	6.5	w.	23	sw.	8	24	6	1	1.7	.0	.0
Tonopah	6,090	12	20	------	------	------	72.4	----	94	1	86	50	19	59	37	52	37	32	.72	----	5	8.5	se.	24	----	----	----	----	----	2.2	.0	.0
Winnemucca	4,344	18	56	25.62	29.93	+.05	70.1	+.8	95	5	89	41	17	51	48	51	35	34	.06	−.1	2	7.0	sw.	27	sw.	17	24	4	3	2.1	.0	.0
Modena	5,473	10	43	24.68	29.89	+.03	69.0	−.2	95	1	85	42	16	53	41	53	42	46	1.74	+.4	11	9.8	sw.	30	e.	5	14	13	4	4.0	.0	.0
Salt Lake City [1]	4,227	32	46	25.73	29.88	−.03	74.0	------	99	1	89	47	14	59	40	56	43	39	.23	----	4	9.3	se.	40	nw.	13	15	14	2	3.5	.0	.0
Grand Junction	4,602	60	68	25.41	29.92	+.02	77.0	+1.6	102	1	90	51	19	64	37	58	45	39	.69	−.5	7	6.3	se.	26	sw.	28	16	10	5	3.9	.0	.0
Northern Plateau							**69.6**	**+0.2**										**38**	**0.24**	**−0.2**										**2.4**		
Baker	3,471	36	54	26.48	29.99	+.04	64.4	−.2	93	27	82	39	15	46	44	50	38	44	.25	−.2	3	5.9	n.	18	n.	1	20	7	4	2.6	.0	.0
Boise	2,739	79	87	27.14	29.93	.00	71.8	.0	95	27	87	47	14	57	38	55	42	38	.03	−.2	1	5.3	nw.	27	se.	24	20	9	2	2.3	.0	.0
Pocatello	4,477	60	68	25.50	29.92	.00	69.8	+.2	94	11	84	40	15	52	40	53	38	36	.68	.0	6	8.2	se.	28	sw.	2	21	6	4	3.2	.0	.0
Spokane	1,929	101	110	27.94	29.95	.00	67.8	−.3	93	26	82	45	9	54	43	52	37	38	.29	−.3	3	6.5	s.	21	sw.	1	23	4	4	2.5	.0	.0
Walla Walla	991	57	65	28.90	29.96	.00	72.6	−.1	100	26	86	53	8	60	36	55	39	33	.02	−.5	1	6.1	s.	20	w.	1	25	3	3	2.2	.0	.0
Yakima	1,076	58	67	28.83	29.97	------	71.2	+1.7	98	26	86	48	2	57	35	55	41	38	.15	.0	2	7.0	nw.	21	nw.	5	26	4	1	1.5	.0	.0
North Pacific Coast Region							**62.9**	**−0.6**										**68**	**0.32**	**−0.5**										**4.3**		
North Head	211	11	56	29.90	30.12	+.09	57.4	−.2	66	1	61	50	24	54	10	55	54	90	.64	−.4	6	12.3	nw.	33	nw.	3	6	11	14	6.8	.0	.0
Seattle	125	90	321	29.94	30.06	+.06	63.3	+.2	81	24	72	50	22	54	28	56	51	68	.48	−.2	7	7.1	n.	18	s.	18	12	11	8	4.4	.0	.0
Tacoma	194	172	201	29.88	30.08	+.06	62.0	−.6	77	15	71	47	22	53	25	----	----	----	.09	−.6	3	7.3	n.	20	sw.	18	10	16	5	4.8	.0	.0
Tatoosh Island	86	10	54	30.01	30.10	+.10	54.2	−1.1	62	31	58	46	30	51	12	53	52	92	.65	−1.4	10	7.9	sw.	21	s.	18	1	13	17	7.6	.0	.0
Medford [1]	1,329	29	58	28.60	29.98	------	70.0	−1.1	96	4	89	46	9	52	46	55	42	44	T	−.2	0	----	nw.	----	----	----	29	2	0	.8	.0	.0
Portland, Oreg	154	68	106	29.91	30.07	+.06	66.2	−.5	86	15	77	49	22	56	31	57	51	62	.35	−.3	3	6.0	nw.	15	nw.	10	15	11	5	3.8	.0	.0
Roseburg	510	45	76	29.50	30.04	+.04	67.4	−.6	91	16	83	47	23	52	40	56	47	55	.00	−.3	0	5.3	n.	18	n.	7	24	5	2	1.9	.0	.0
Middle Pacific Coast Region							**67.8**	**+0.6**										**60**	**T**	**0.0**										**2.8**		
Eureka	60	72	88	29.99	30.06	+.06	55.9	−.1	65	27	60	49	20	52	15	53	51	84	T	−.2	0	6.5	nw.	24	sw.	22	8	13	10	5.8	.0	.0
Redding [1]	722	20	34	------	------	------	80.8	+.3	105	4	95	58	23	67	35	58	39	27	.00	.0	0	8.2	nw.	25	nw.	1	30	1	0	.8	.0	.0
Sacramento	66	92	115	29.81	29.88	+.03	74.2	+1.3	103	1	90	52	9	58	44	59	49	48	.00	.0	0	7.4	s.	22	sw.	22	29	1	1	.5	.0	.0
San Francisco	155	112	132	29.78	29.95	+.03	60.1	+1.0	78	2	66	52	10	54	22	55	52	79	.00	.0	0	10.2	w.	26	w.	24	13	14	4	4.0	.0	.0
South Pacific Coast Region							**74.5**	**+1.0**										**62**	**0.01**	**0.0**										**2.8**		
Fresno	327	97	105	29.52	29.86	+.04	80.0	−.7	107	1	96	57	23	64	38	61	47	38	.00	.0	0	7.0	nw.	15	nw.	31	28	3	0	.8	.0	.0
Los Angeles	338	159	191	29.56	29.91	+.03	73.9	+2.8	95	1	84	59	19	64	31	64	60	69	T	.0	0	5.4	sw.	13	w.	30	18	12	1	2.9	.0	.0
San Diego	87	62	70	29.82	29.91	+.02	69.5	+.8	78	4	74	62	19	65	14	64	62	80	.03	.0	1	6.8	nw.	16	nw.	20	13	14	4	4.7	.0	.0
West Indies																																
San Juan, P. R	82	9	54	29.88	29.96	------	80.4	−.1	87	25	84	73	7	77	11	----	----	----	4.72	−1.3	20	16.0	e.	32	e.	7	10	20	1	4.5	.0	.0
Panama Canal																																
Balboa Heights	118	6	92	------	------	------	----	----	----	----	----	----	----	----	----	----	----	----	------	----	----	------	----	----	----	----	----	----	----	----	----	----
Cristobal	36	6	97	------	------	------	----	----	----	----	----	----	----	----	----	----	----	----	------	----	----	------	----	----	----	----	----	----	----	----	----	----
Alaska																																
Fairbanks	454	11	87	[2]29.48	[2]29.99	------	54.6	−.6	78	7	64	36	26	46	33	51	47	79	2.69	+.7	19	5.7	s.	21	s.	1	4	6	21	7.8	.0	.0
Juneau	80	96	116	[2]29.99	[2]30.08	------	56.8	+1.5	77	9	65	45	21	49	30	52	48	76	4.92	−2.3	13	5.0	s.	19	se.	2	13	2	16	5.6	.0	.0
Nome	22	5	32	------	------	------	----	----	----	----	----	----	----	----	----	----	----	----	------	----	----	------	----	----	----	----	----	----	----	----	----	----
Hawaiian Islands																																
Honolulu	38	86	100	29.94	29.98	------	78.4	.0	85	25	83	71	19	74	12	71	68	73	3.93	+2.6	17	8.6	e.	23	s.	19	14	10	7	4.8	.0	.0
Late Report for July, 1938																																
Lexington, Ky	989	6	----	------	------	------	77.5	+1.6	96	7	89	59	5	66	34	----	----	----	6.81	+3.2	14	------	sw.	----	------	----	15	8	8	----	.0	.0

[1] Observation taken at airport.

[2] Pressure not reduced to a mean of 24 hours.

TABLE 3.—*Data furnished by the Canadian Meteorological Service, August 1938*

Stations	Altitude above mean sea level, Jan. 1, 1919	Pressure			Temperature of the air						Precipitation		
		Station reduced to mean of 24 hours	Sea level reduced to mean of 24 hours	Departure from normal	Mean max.+ mean min.÷2	Departure from normal	Mean maximum	Mean minimum	Highest	Lowest	Total	Departure from normal	Total snowfall
	Feet	*In.*	*In.*	*In.*	*° F.*	*° F.*	*° F.*	*° F.*	*° F.*	*° F.*	*In.*	*In.*	*In.*
Cape Race, Newfoundland	99												
Sydney, Cape Breton Island	48	29.87	29.92	−0.06	67.8	+4.1	76.7	58.9	89	47	5.85	+2.15	0.0
Halifax, Nova Scotia	88	29.69	29.94	−.05	67.4	+2.9	74.4	60.5	87	50	4.12	−.31	.0
Yarmouth, Nova Scotia	65	29.85	29.95	−.05	64.4	+3.8	72.8	55.9	81	45	.97	−2.53	.0
Charlottetown, Prince Edward Island	38	29.85	29.93	−.03	67.8	+3.4	75.1	60.4	84	48	2.94	−.23	.0
Chathem, New Brunswick	28	29.78	29.89	−.06	65.9	+1.4	75.9	55.9	90	39	3.21	−.86	.0
Father Point, Quebec	20												
Quebec, Quebec	296	29.60	29.92	−.03	65.3	+1.7	71.9	58.7	89	47	11.87	+8.04	.0
Doucet, Quebec	1,236	28.60	29.93	−.06	59.8	+2.8	70.7	48.9	82	28	8.46	+4.90	.0
Montreal, Quebec	187	29.74	29.94	−.02	70.9	+4.1	78.6	63.3	93	50	5.88	+2.42	.0
Ottawa, Ontario	236	29.70	29.94	.00	69.1	+3.4	80.3	58.0	93	40	3.75	+.87	.0
Kingston, Ontario	285	29.64	29.96	−.02	71.2	+4.6	79.0	63.3	85	50	1.83	−.92	.0
Toronto, Ontario	379	29.58	29.98	−.01	72.9	+5.9	82.7	63.1	92	53	2.06	−.74	.0
Cochrane, Ontario	930	28.87	29.89	−.07	61.7	+1.7	71.5	51.9	83	37	6.46	+3.16	.0
White River, Ontario	1,244	28.63	29.95	−.01	60.8	+3.1	73.5	48.2	84	30	3.84	+.89	.0
London, Ontario	808	29.14	30.00	+.03	71.0	+4.6	81.4	60.6	89	47	1.51	−1.33	.0
Southampton, Ontario	656	29.28	29.98	−.02	70.1	+5.3	79.2	61.0	92	48	3.69	+1.39	.0
Parry Sound, Ontario	688	29.28	29.96	−.02	70.3	+6.1	79.5	61.2	92	47	2.80	+.04	.0
Port Arthur, Ontario	644	29.22	29.92	−.05	62.7	+2.3	73.3	52.1	89	38	4.25	+1.46	.0
Winnipeg, Manitoba	760												
Minnedosa, Manitoba	1,690	28.12	29.90	−.03	64.6	+4.0	77.7	51.5	92	38	1.75	−.38	.0
Le Pas, Manitoba	860	28.92	29.88	−.03	61.2	+.6	72.8	49.7	85	38	3.76	+1.68	.0
Qu'Appelle, Saskatchewan	2,115	27.66	29.92	−.02	62.8	+1.0	77.5	48.1	93	40	.95	−.98	.0
Moose Jaw, Saskatchewan	1,759	27.95	29.90	+.02	64.4	+1.1	78.5	50.4	95	42	1.11	−.57	.0
Swift Current, Saskatchewan	2,392	27.38	29.90	−.02	62.5	−.8	75.4	49.6	92	38	1.50	−.34	.0
Medicine Hat, Alberta	2,144	27.48	29.94	+.04	64.0	−2.7	78.2	49.7	94	39	1.60	+.18	.0
Calgary, Alberta	3,428	26.36	30.00	+.06	57.7	−1.0	70.6	44.8	89	36	1.87	−.46	.0
Banff, Alberta	4,521												
Prince Albert, Saskatchewan	1,450	28.38	29.92	−.01	60.7	+.6	71.9	49.5	90	41	2.53	+.29	.0
Battleford, Saskatchewan	1,592	28.20	29.92	−.01	61.2	+.7	74.8	47.7	91	34	.98	−.92	.0
Edmondton, Alberta	2,150	27.70	29.98		57.0	−2.4	68.7	45.3	81	35	3.70	+1.30	.0
Kamloops, British Columbia	1,262												
Victoria, British Columbia	230	29.82	30.07	+.05	58.9	−1.0	66.7	51.1	78	48	.55	−.06	.0
Barkerville, British Columbia	4,180												
Estevan Point, British Columbia	20												
Prince Rupert, British Columbia	170	29.92	30.11	+.08	57.0	−.6	64.6	49.3	78	46	3.20	−2.00	.0
St. George's, Bermuda	158		30.11	+.01	81.6	+2.0	88.5	74.8	94	70	2.26	−3.70	.0
LATE REPORTS FOR JULY 1938													
Cape Race, Newfoundland	99				53.6	−1.6	60.4	46.8	72	39	3.95	+0.30	0.0
Father Point, Quebec	20	29.84	29.87	+0.01	60.8	+3.0	68.0	53.5	76	35	5.93	+2.75	.0
Montreal, Quebec	187	29.72	29.92	+.01	70.5	+1.0	78.4	62.6	88	53	3.44	−.24	.0

TABLE 4.—*Severe local storms, August 1938*

[Compiled by Mary O. Souder from reports submitted by Weather Bureau officials]

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Vincennes, Ind., vicinity of	1			0		Tornado	After apparently circling the city and dipping 3 times to the Wabash River producing the semblance of waterspouts, passed off to the northeast without touching the ground.
Mossic, Pa., vicinity of	1	P. m.			$67,000	Electrical	The powder mill of the Dupont Powder Co. struck by lightning. 5 buildings destroyed and windows broken over an area from Scranton to Pittston.
Hand County, S. Dak.	2	do	1,320			do	13 miles northwest of Miller, lightning set fire to prairie grass, destroying a 3½-mile strip of hayland and 8 stacks of wheat.
Chattanooga,[1] Tenn., vicinity of.	2	do		1		Thunderstorm	Woman killed in her home; house damaged; streets flooded; light and telephone service disrupted.
Greeley, Colo., vicinity of	2					Tornadic wind	Trees uprooted; telephone and power lines down; several small buildings destroyed.
Crocketville, S. C.	4				24,200	Electrical	Warehouse containing 400 bales of cotton and fertilizer burned.
Cuba Lake, N. Y.	4					Thunderstorm	A cottage damaged by lightning with 16 persons injured. Reports indicate that some of the injured had their eyebrows burned off and nearly all were knocked down.
Cocke, Sevier to Blount Counties, Tenn.	4	Midnight		8		Heavy rain	At Pittman Center, a cottage was washed away, 8 persons losing their lives. Numerous small landslides and several bridges washed out along Little Tennessee River. Some automobiles ruined by debris.
Dunlow, W. Va.	4					do	Creek overflowed; motor traffic on U. S. Route 52 suspended for a day.
Chickasaw County, Iowa	5	A. m.			3,000	Electrical	Several farm buildings and automobile destroyed; 2 horses burned to death.
Monmouth, Ill.	5					Wind	3 barns destroyed.
Dubuque and Dyersville, Iowa and vicinities.	5	3–10:30 a. m.		1		Thundersqualls and hail.	In Dubuque streets and basements flooded; corn and other crops blown down. Near Dyersvile a man was killed by lightning and a barn burned.

See footnote at end of table.

TABLE 4.—*Severe local storms, August 1938*—Continued

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Jefferson, Polk, Dallas, Jasper, Marion, and Wapello Counties, Iowa.	5	2–4 p. m.			$55,000	Wind, electrical, and hail.	Greatest damage occurred in Jasper County, $50,000, where much corn was flattened over a strip 14 miles long and 12 miles wide; highways flooded. Crop loss and property damaged in the other counties mentioned.
Mahaska, Monroe, Appanoose, Keokuk, Wapello, Davis, Jefferson, Henry, and Van Buren Counties, Iowa.	5	6 p. m.			200,000	do	$50,000 crop loss in Wapello County, where, in the vicinity of Ottumwa greatest property damaged occurred, being estimated at $100,000; 5 persons injured necessitating hospital treatment and scores of others slightly injured. In other counties indicated wires were down; property damaged and loss to crops.
Adams, Taylor, Union, Clarke, Lucas, Wayne and Henry Counties, Iowa.	5–6					Electrical, wind, rain, and hail.	Storm began midnight of the 5th. Considerable property damaged from lightning. Corn flattened; small streams overflowed. Greatest damage along highway 34, west of Osceola.
Palto Alto County, Iowa	6					Wind, rain, and hail.	Loss to corn and other crops and to gardens.
South Dakota, eastern and central portions.	6	5 p. m.–midnight.			100,000	Wind and hail	Property damaged.
Minnesota, extreme southern counties.	6–7				572,000	Thundersqualls and hail.	Barns demolished; houses damaged; street carnival wrecked; trees uprooted; telephone and power service disrupted; livestock killed; much loss to growing crops. Estimated total loss from thunderstorms, $40,000. Hail damage mostly to corn and truck over a wide area, some fields of corn a total loss. Many windows broken; much poultry perished and several persons injured. Loss from hail, $532,000.
Falls City, Nebr.	7	2:30–3:30 p. m.	880		1,000	Wind	No details.
Hastings and Pauline, Nebr.	7	4–6 p. m.	[1] 5		10,000	Wind and hail	Do.
Westly, Mont.	8	4–5 p. m.	[1] 1			Hail	Considerable damage to wheat and small grains; path 10 miles long.
Savage and Crane, Mont.	8	5–6 p. m.	[1] 7		36,000	Hail and wind	Loss from hail, $30,000, to sugar beets, alfalfa, garden truck, and uncut grain and to property, $5,000. Wind damage, $1,000.
Mingo County, W. Va.	8	5–8 p. m.			10,000	Heavy rain	Streets in Williamson damaged; post office and stores inundated; several automobiles carried away; 2 Norfolk & Western R. R. trestles on Sycamore Creek damaged. Landslides on U. S. Route 52 and along the Williamson-Matewan road; crops washed out.
Antioch and Eastatoe, S. C.	8	8–8:30 p. m.			5,000	Hail	Crop loss, 20 percent; small property damage.
Chestertown, N. Y.	8					Rain, hail, and wind.	Power and telephone wires down; roads washed and blocked with uprooted trees.
Oquawka, Ill.	8				26,000	Hail	Loss to crops.
South Dakota, southeastern portion.	9	10–11 p. m.				Wind and hail	Trees broken and uprooted; wires down. About 6 miles northeast of Madison, hail stripped corn in a belt 4 to 6 miles wide and about 6 miles long. Much hail damage in the vicinity of Tripp.
Jasper, Ind.	9	P. m.			1,600	Thunderstorm	Barn destroyed.
Mitchell, Ind.	9	do			3,000	do	Do.
Parkston,[2] Iowa	9				3,000	Wind and rain	Several buildings, trees, and telephone poles damaged. Loss to corn crop.
Kinderhook, N. Y.	9					Thundersquall	Many trees uprooted; highways blocked; damage to telephone and power lines and to buildings.
Johnson City, Tenn.	9				100,000	Rain	Sudden rains caused Brush Creek to overflow. Property damaged.
Milwaukee, Wis.	9–10	P. m.				Thunderstorm	Several buildings struck by lightning; many transmission lines down.
Ionia, Mich., vicinity of.	10	A. m.				Electrical and wind.	2 barns burned; many fields of corn damaged by wind.
Loudoun County, Va., south-central portion.	10	4 p. m.			2,000	Hail	Loss mostly to corn.
Buffalo, N. Y., and vicinity	10			1	25,000	Thunderstorm	10 persons injured; streets and cellars flooded; electric service interrupted.
Lockport, N. Y., vicinity of	10				8,000	Electrical	3 barns and contents burned; livestock killed.
West Hope, Ohio	10				4,000	Thunderstorm	Barn destroyed by lightning.
Racine, Wis.	10		[1] 10		250,000	Wind and rain	Nearly 1,000 large trees blown down on streets; wire service disrupted; almost 4 inches of rain recorded. Lightning struck a street car, disabling it and forcing its 3 passengers and crew to spend the night sleeping in the chairs. A washout reported on the Chicago, Milwaukee & St. Paul R. R. at Racine. Farm buildings destroyed by lightning. Hundreds of acres of ripening corn near Sturtevant leveled with much loss. Water 2 feet deep in streets in Racine; sewers inadequate; basements flooded.
Teton Valley, Idaho, northwestern corner.	11	P. m.	2,640		11,000	Hail	Considerable damage to gardens and grains. Path 3 miles long.
Fountain, Rocky Ford, Franktown, and Cotopaxi, Colo.	11					Heavy rain and flood.	Railroad schedules and telephone communications disrupted for several hours; basements flooded; 2 bridges destroyed at Franktown; a railroad bridge with 100 feet of track, destroyed at Cotopaxi.
Stigler, Okla., vicinity of	12	5 p. m.	880		1,200	Hail	Considerable damage over a small area; crop loss, $1,200.
Watts, Okla., vicinity of	12	5:30 p. m.	[1] 2		700	Wind	Trees uprooted. Property damage, $200; path 5 miles long.
Logan County, W. Va.	12					Heavy rain	Roads inundated; highways blocked.
Jerome, Ariz.	13				7,500	do	Property damaged.
Louisiana, southwestern and central-interior.	14	7:30 p. m.			243,000	Tropical storm	Winds of hurricane force and torrential rains damaged buildings, wires, oil derricks, piers, and other property to the extent of $133,000. Crop loss principally rice, but including much cotton and corn, $110,000.
Oklahoma City, Okla., vicinity of.	15	4 p. m.		1	50,000	Wind, electric, and rain.	Property damaged; boy killed by lightning, while working in the field.
Kinder, La.	15	9:30 a. m.	70	0	700	Small tornado	House and 2 barns destroyed; trees and fences damaged.
Hinton, Eakly, and Hydro, Okla., and vicinity.	15	11 p. m.	[1] 20		25,000	Wind	Small crop loss; property damage, $25,000.
Jasper, Mich., vicinity of.	16	P. m.				do	Several barns destroyed.
New Baltimore, Mich., vicinity of.	16	do			100,000	Tornadic winds	4 persons injured; 14 houses and 9 barns damaged; automobiles overturned; a gas station blown 100 yards.
Rushmore, Minn.	16	8 p. m.	[1] 3			Thunderstorm and hail.	40 to 60 percent of loss to growing crops over a path 5 miles long.
Mount Pleasant, Mich., vicinity of.	16	9:30 p. m.				Tornadic wind	3 persons injured when a garage and automobile were wrecked and a house was blown from its foundation and demolished, the roof being carried 100 yards. A washing machine on the back porch carried 50 yards into a field. A dresser was demolished, the mirror being recovered without a scratch. Trees uprooted over a small area near the house. Across the road, a house had only a broken window to indicate a disturbance in this area.
Mount Carroll, Ill.	16		1,200			Rain	Damage to roads and city park.
Parkersburg, W. Va.	17	4:30 p. m.	500			Thundersqualls	Property damaged.
Cortland, N. Y., vicinity of.	17		8,000			Electrical and wind.	Large dairy barn and contents burned; 11 cattle killed in a pasture much wind damage to trees, telephone, and power lines.
Ogdensburg, N. Y., vicinity of	17		6,000			Thunderstorm	Large barn and silo burned.
Oswego and Nichols, N. Y., and vicinities.	17					Heavy rain	Many highway bridges and a section of railroad track washed out.
Highmore, S. Dak., vicinity of.	18	5 p. m.		0	6,000	Tornado	Several buildings damaged and a new barn wrecked; path narrow.
Wolsey to Broadland, S. Dak., and vicinities.	18	8 p. m.	100–200	0		do	Farm buildings destroyed and livestock killed; small crop loss; path 6 miles long.

See footnotes at end of table.

TABLE 4.—*Severe local storms, August 1938*—Continued

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Cavour to Iroquois, S. Dak., and vicinities.	18	8:30 p. m.			$3,000	Wind	Small buildings wrecked; houses and barns damaged; path narrow.
Ulysses, Kans., and vicinity	18	P. m.	[1] 4			Heavy hail	Loss to crops not estimated; path 12 miles long.
Swan River to Cedar Valley, Minn., and vicinities.	19	4:30 p. m.	67	0	10,000	Tornado	3 funnel-shaped clouds observed simultaneously, about 3 miles southwest of Rabey, moving northeastward. 2 of these seemed to merge about ¼ mile north of Rabey, while the third traveled about 15 miles away. 5 persons seriously injured; several houses damaged; barn and smaller buildings demolished; 14 cattle moved several hundred feet; topsoil blown; path 33 miles long. Loss would have been greater, but for the fact the tornado passed over a sparsely settled region.
Payne, Minn., and vicinity	19	5:30 p. m.				Tornadic wind	All buildings on an 80-acre farm leveled; 2 persons injured.
Carver, Hennepin, Crow Wing, Cass, and Otter Tail Counties, Minn.	19				29,700	Thundersqualls	Loss to growing crops in Otter Tail County, $8,500; property damage, $21,200.
Soldier to Leavenworth, Kans., and vicinities.	20	4:30–6:30 p. m.	[1] 5–30	1	1,060,000	Rain, hail, and wind.	Storm worst in 50 years. Water 5 feet deep flowed down several streets. Man crushed to death in his automobile under a large roof torn off by the storm. Wind velocity of 57 miles per hour registered at Fort Leavenworth, where the width of the storm path was 10 miles. Damage from hail, $110,000, mostly to growing crops. Length of path 60 miles.
Chicago, Ill.	20			6		Wind and rain	Squalls over Lake Michigan responsible for drowning of 6 persons.
Pontiac, Ill.	20					Hail	Loss to crops.
Winnebago County, Ill.	20				7,000	Hail	Crop loss $5,000; property damage, $2,000.
Grand River Valley, Mich, from Muskegon to Lansing.	20				200,000	Wind, electrical, and rain.	About half the damage estimated occurred in Muskegon and vicinity where 4 inches of rain flooded streets and basements. The Ionia fair was brought to a premature close with loss of $50,000. In Montague the plant of the Casting Co. sustained heavy damage from flooding. In Grand Rapids, Holland, and Saranac much damage to trees, communication, and power lines.,
Aurora, Ill.	21				5,000	Electrical	Barn burned.
Paynesville, Minn., and vicinity.	22	8:30 p. m.	165		60,500	Tornadic wind and hail.	Barns, outbuildings, and houses demolished or badly damaged; windows broken; poles and wires down; trees uprooted; some livestock killed; much loss to corn crop; path about 20 miles long.
Rushford, Minn., and vicinity.	22	10–11:30 p. m.				Wind, rain, and hail.	Storm assumed tornadic proportions in Rushford about 11:30 p. m., where damage was greatest. Path narrow and about a mile long.
Valley Springs, S. Dak.	22	P. m.				Heavy hail	Windows broken; loss to corn crop.
La Crosse, Wis., and vicinity	22	do				Thundersquall	Considerable damage to wire and power service outside the city in open places.
Madison, Wis.	23	Midnight–2:25 a. m.				do	Wires down; trees damaged; loss to crops. On rural districts; some buildings unroofed.
Wisconsin Dells, Wis., 6 miles northwest.	23	1 a. m.	110	0	5,000	Tornado	House, 3 barns, 2 garages, and other small buildings damaged; path 3 miles long.
Rosedale, Mont.	23	5 p. m.	[1] 2		1,000	Hail	Loss to crops; path 10 miles long.
Chicago,[2] Ill., and vicinity	24	A. m.			750	Electrical	A 75-foot tower of a hospital and a residence struck by lightning.
Elizabeth, Ill.	24	do			500	do	13 cows lying under 2 trees killed by lightning.
Muncie, Ind., vicinity of.	24			0		Tornado	Funnel-shaped cloud appeared, but did not strike the ground doing no damage.
Mount Holly, N. C., vicinity of.	24	P. m.			100,000	Thunderstorm and wind.	At the hydroelectric power plant of the Duke Power Co., heavy steel stanchions forming a super structure that towered 80 feet above the roof, twisted and bent by the wind, fell over power lines and transformers. At Charlotte, extreme wind velocity of 47 miles was recorded. Houses and automobiles damaged by fallen trees; windows broken; roofs blown off. Many hundreds of dollars' loss; amount not estimated.
Savanna, Ill.	24				500	Hail	Greenhouses damaged.
Morristown and Greenville, Tenn., and vicinities.	24–26				8,000	do	Loss mostly to tobacco crop.
Gupton, N. C.	27	12:30 a. m.	880		10,000	Wind	Property damaged; path about 4 miles long.
Benton, La.	27	3 p. m.		1		do	Several buildings damaged. About the same time, a man was drowned in Cross Lake when a boat overturned in a sudden squall.
Tuskegee, Ala.	27	do	440		5,000	do	Trees uprooted and awnings damaged.
Providence, R. I.	27	3:20–4:30 p. m.	880		30,000	Thunderstorm and hail.	Wires, poles, and buildings damaged.
Long Island, N. Y., north shore eastward from Roslyn.	27	4:30 p. m.				Thunderstorm	In Hicksville boy was killed by lightning while riding his bicycle. Many homes in Glen Cove, Brookville, Locust Valley, Oyster Bay an vicinities without telephone or electric current until nightfall.
Roberta, Ga.	27	P. m.			500	Wind	Roofs and 3 houses damaged; crop loss, $500.
Elrod, Ala.	27		[1] 1		7,000	do	5 smokestacks blown down; buildings damaged.
Pievna, Ala.	27		1,320		5,000	Hail	Loss to crops.
Springfield, Ga.	27				1,000	Wind	Trees blown down; crop loss, $1,000.
Port Aransas, Tex.	28	Noon		0		Tornado	The cloud formed near the jetties and moved northwestward across vacant fields, picking up trees, but struck no ship or other valuable articles at the port or on its northwestward journey.
Pickneyville, Ill.	28				4,000	Electrical	Mine equipment burned.
Coulterville, Ill.	29					do	Barn burned; 4 horses killed.
Orlando, Fla.	29	4:30 p. m.	67		3,000	Wind	Woman received a broken arm when she was knocked to the floor in her home as lightning struck nearby. Roofs blown from small houses and hurled 100 feet. Church lifted from its foundation; wires and trees down. Damage occurred in small area of the city.
Watertown, N. Y.	29–30					Electrical and rain	Telephone and power lines down; gardens and streets flooded. Rainfal measured 1.32 inches.
Clinton, Ill.	30				3,200	Electrical	Residence and barn burned.
Hayden, Colo., 7 miles southwest.	31	12:30 p. m.	2,640		6,000	Heavy hail	Loss to standing wheat.

ADDITIONS TO TABLE 4.—SEVERE LOCAL STORMS, JULY 1938

Phoenix, Ariz., 4 miles east	22	Afternoon			$18,700	Wind	Damage to property.
Arizona, Wellton-Roll district	22				10,000	do	Damage to alfalfa seed crop being harvested.

Erratum.—Table 4, Severe Local Storms, July 1938; delete tornado listed "Arizona,[2] eastern portion" date 23, etc., on page 233.

[1] Miles instead of yards.
[2] From press reports.

U. S. GOVERNMENT PRINTING OFFICE: 1938

Chart I. Departure (°F.) of the Mean Temperature from the Normal, August 1938

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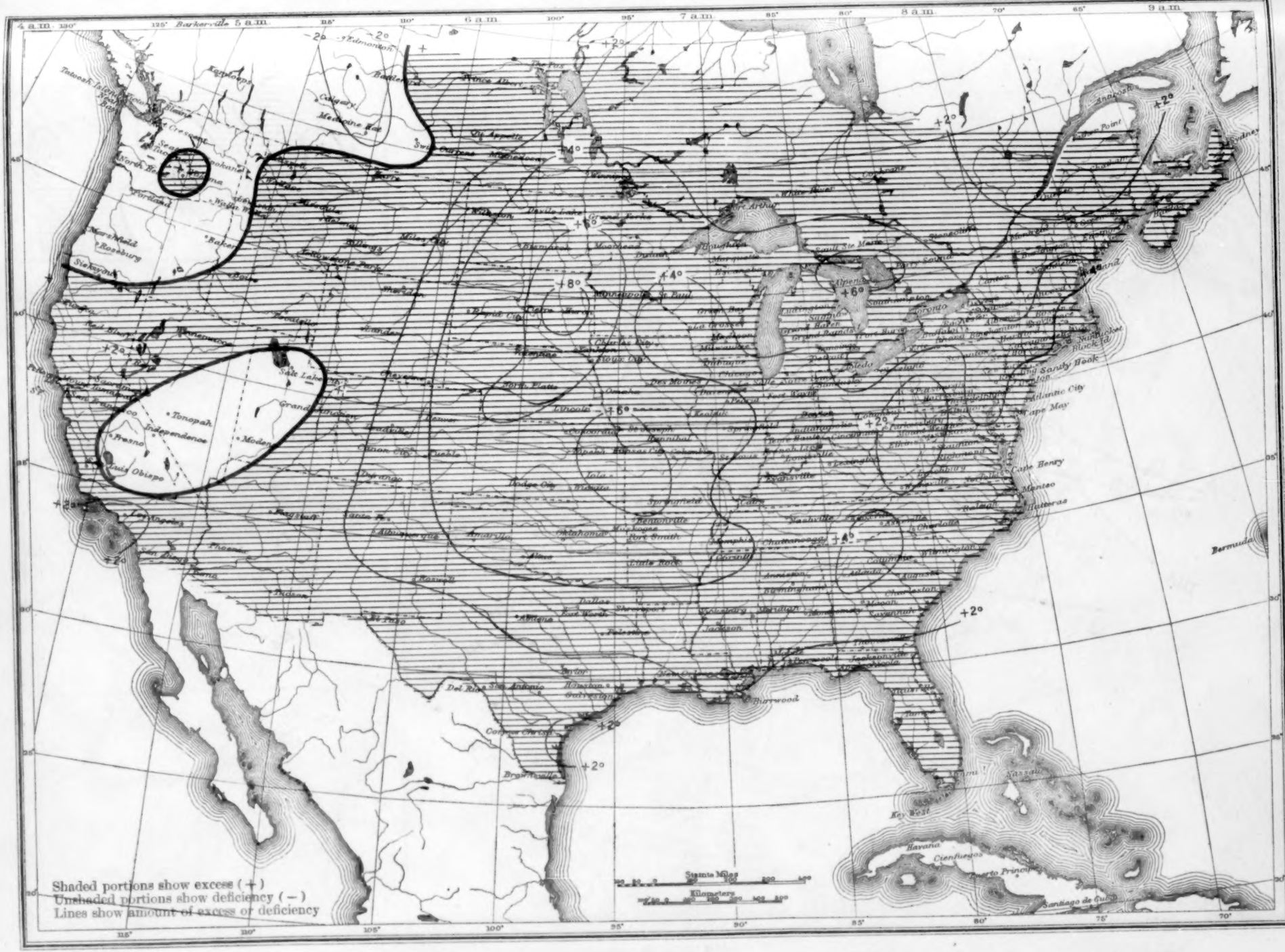
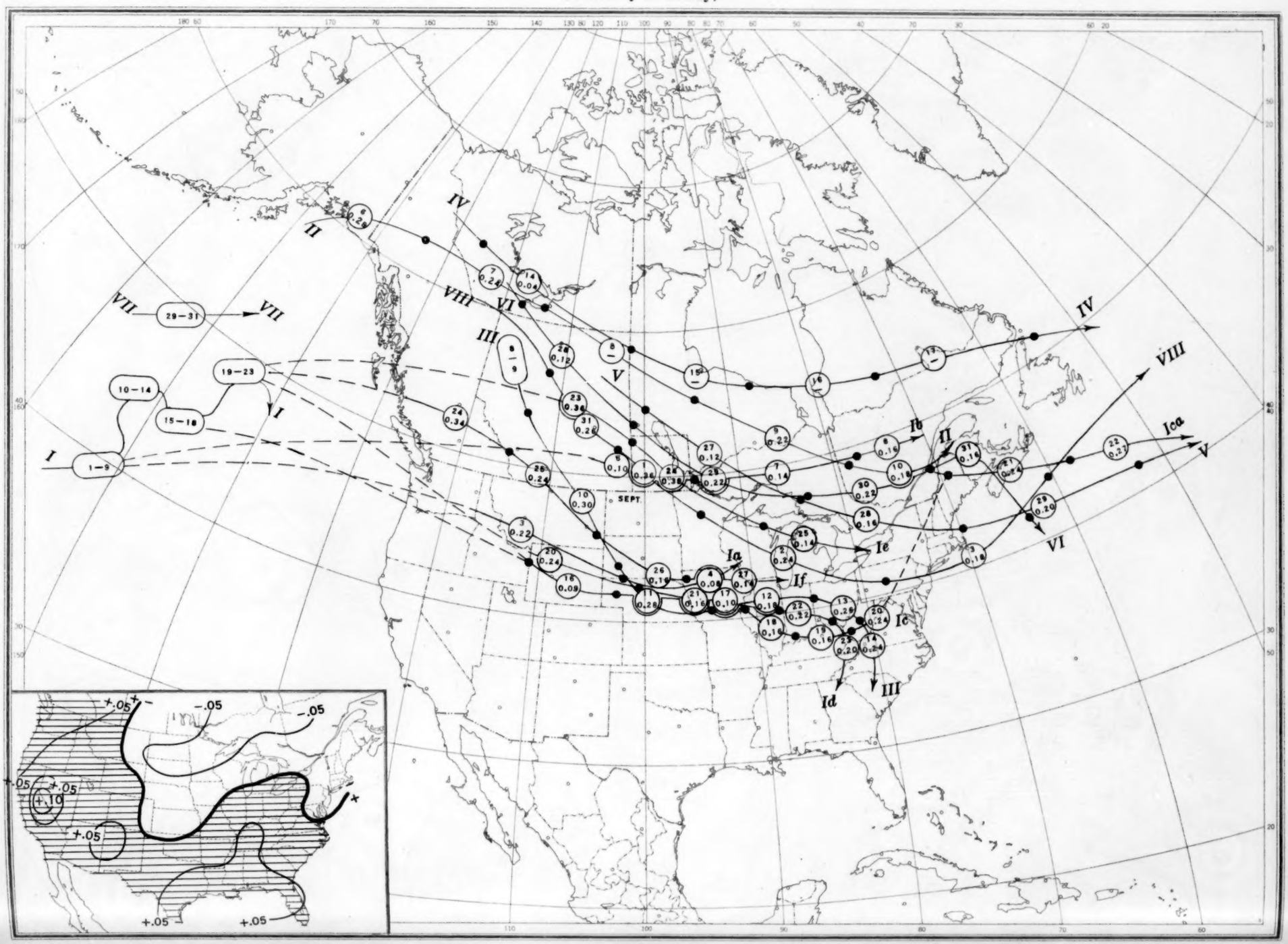


Chart II. Tracks of Centers of Anticyclones, August 1938. (Inset) **Departure of Monthly Mean Pressure from Normal**

(Plotted by W. P. Day)



Circle indicates position of anticyclone at 7 : 30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7 : 30 p. m. (75th meridian time).

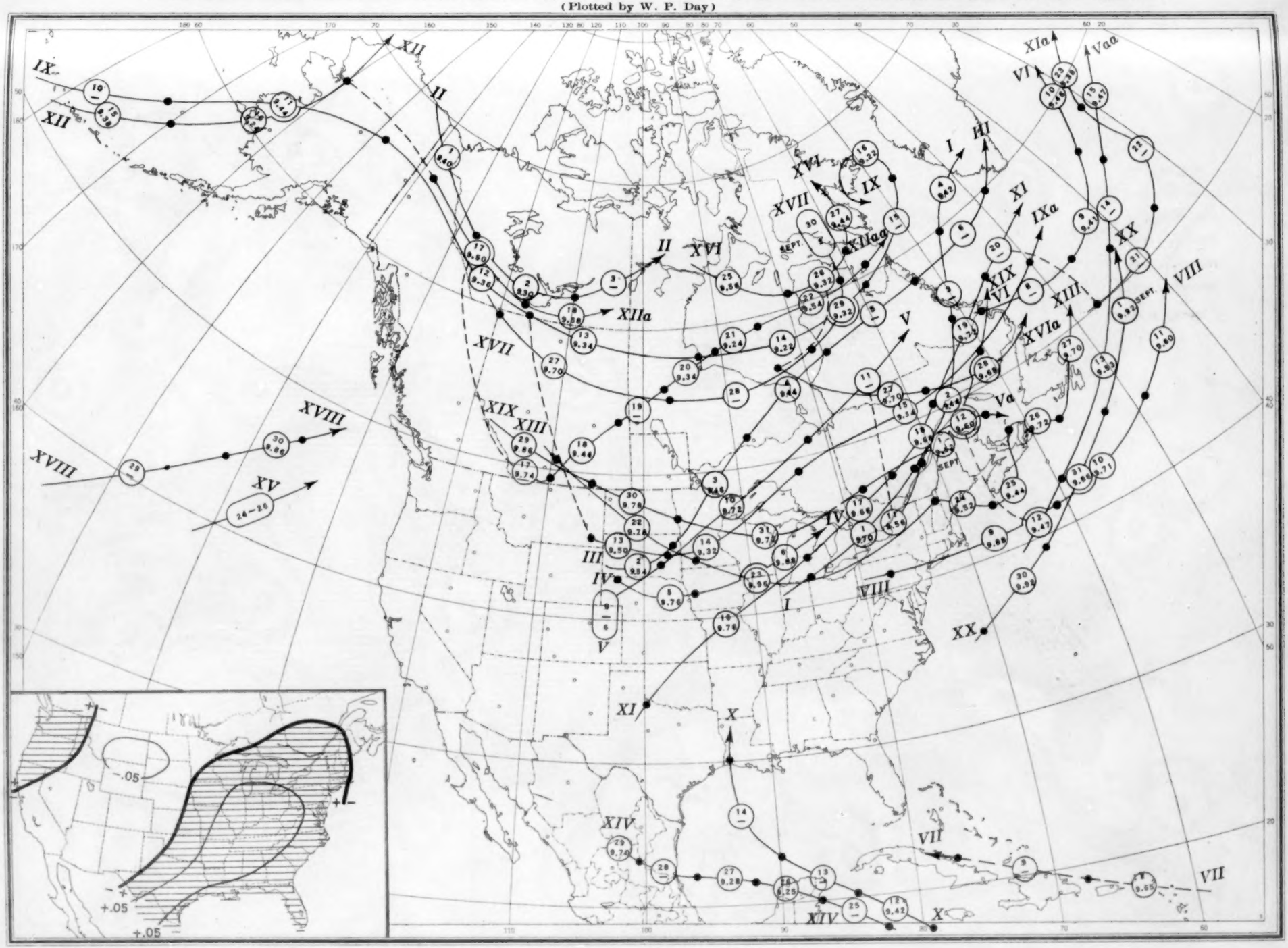
Chart III. Tracks of Centers of Cyclones, August 1938. (Inset) **Change in Mean Pressure from Preceding Month**

(Plotted by W. P. Day)

Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, August 1938. (Inset) **Change in Mean Pressure from Preceding Month**

(Plotted by W. P. Day)



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, August 1938

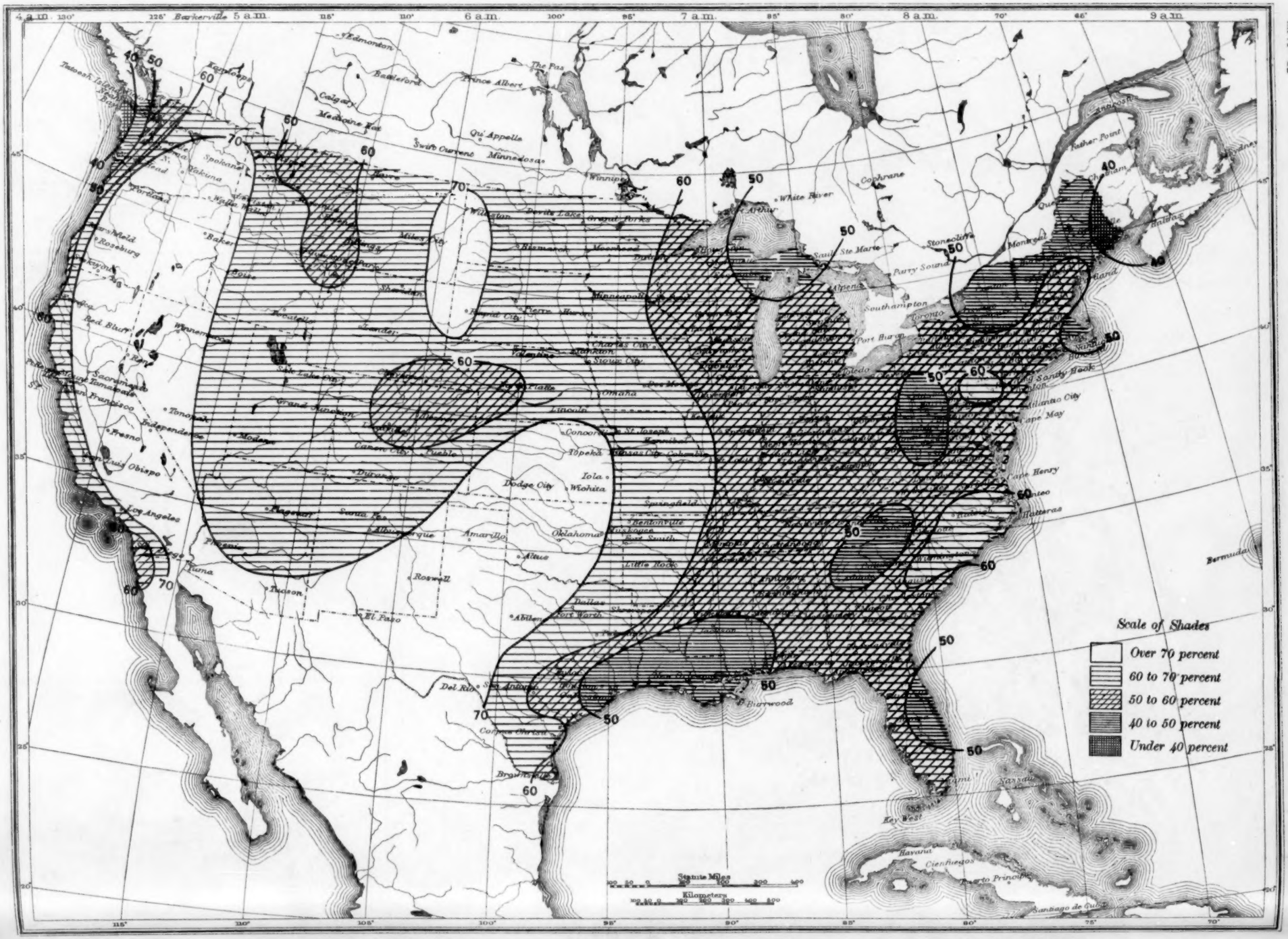


Chart V. Total Precipitation, Inches, August 1938. (Inset) Departure of Precipitation from Normal

Chart V. Total Precipitation, Inches, August 1938. (Inset) **Departure of Precipitation from Normal**

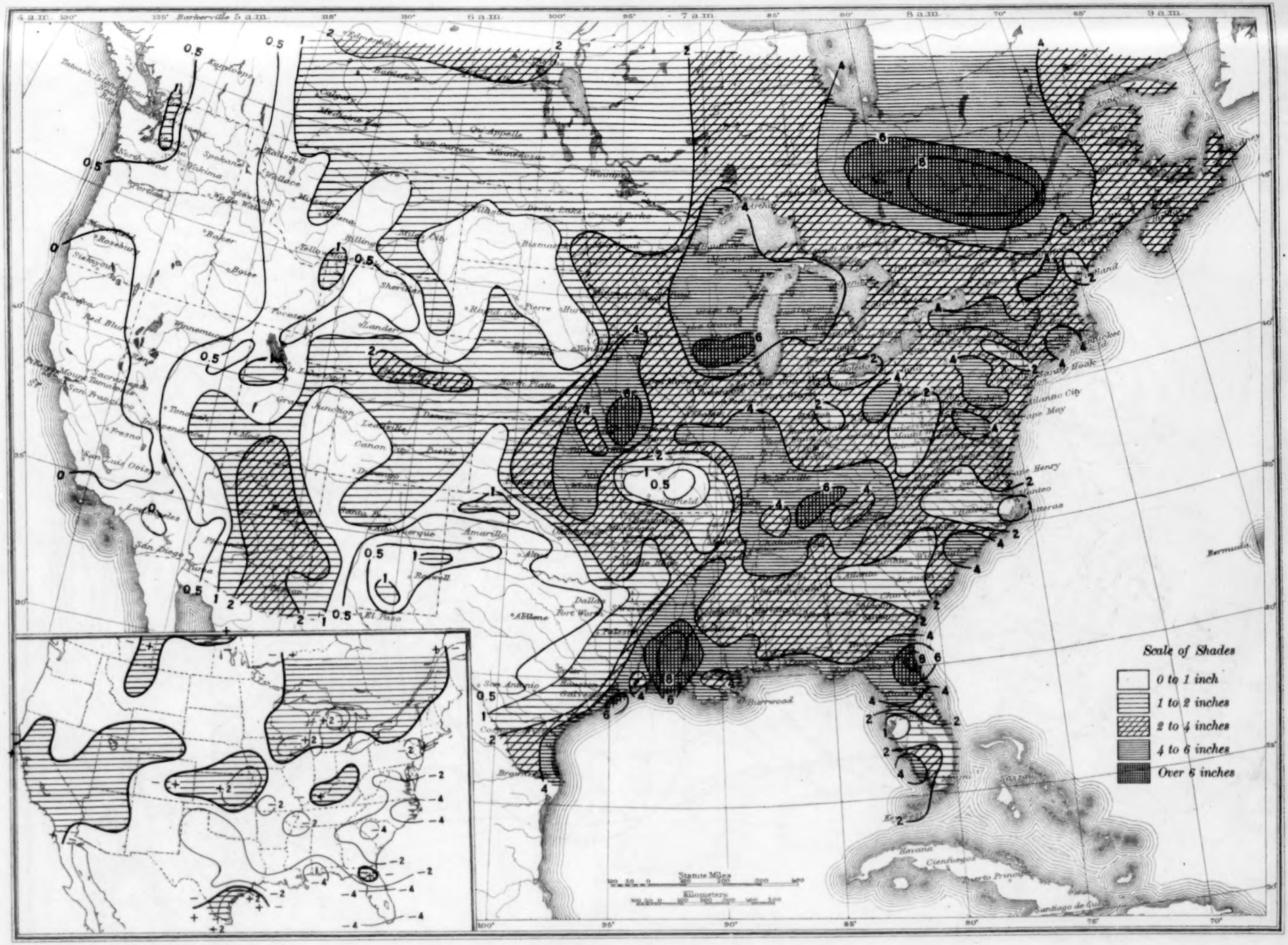


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, August 1938

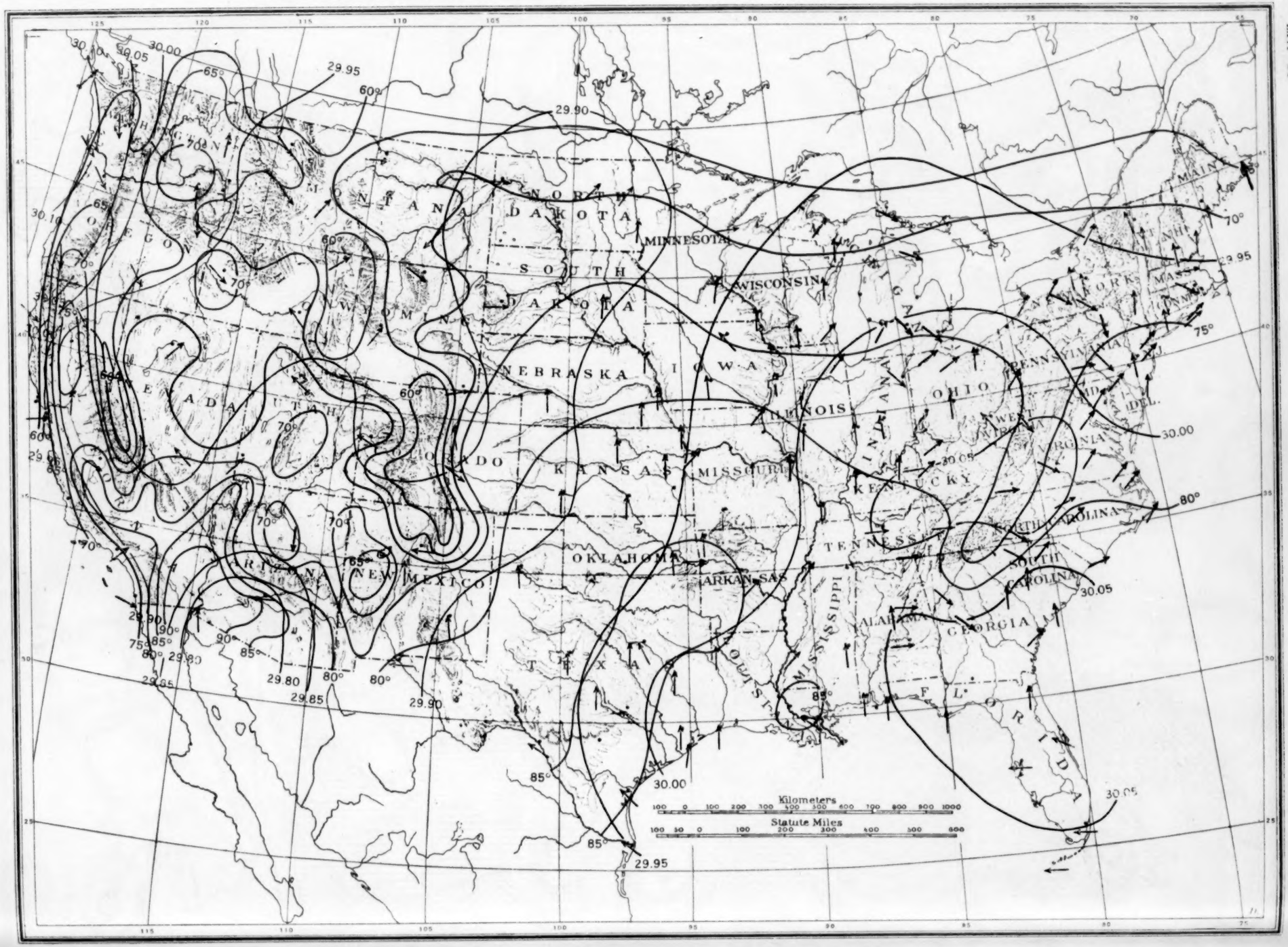


Chart VII. Wind Roses for Selected Stations, August 1938

(Plotted by W. W. Reed)

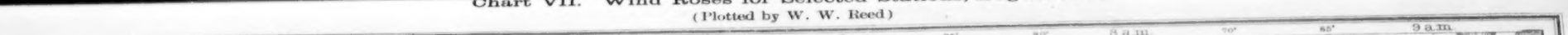


Chart VII. Wind Roses for Selected Stations, August 1938

(Plotted by W. W. Reed)

Chart IX. Weather Map of North Atlantic Ocean, August 26, 1938
(Plotted from the Weather Bureau Northern Hemisphere Chart)

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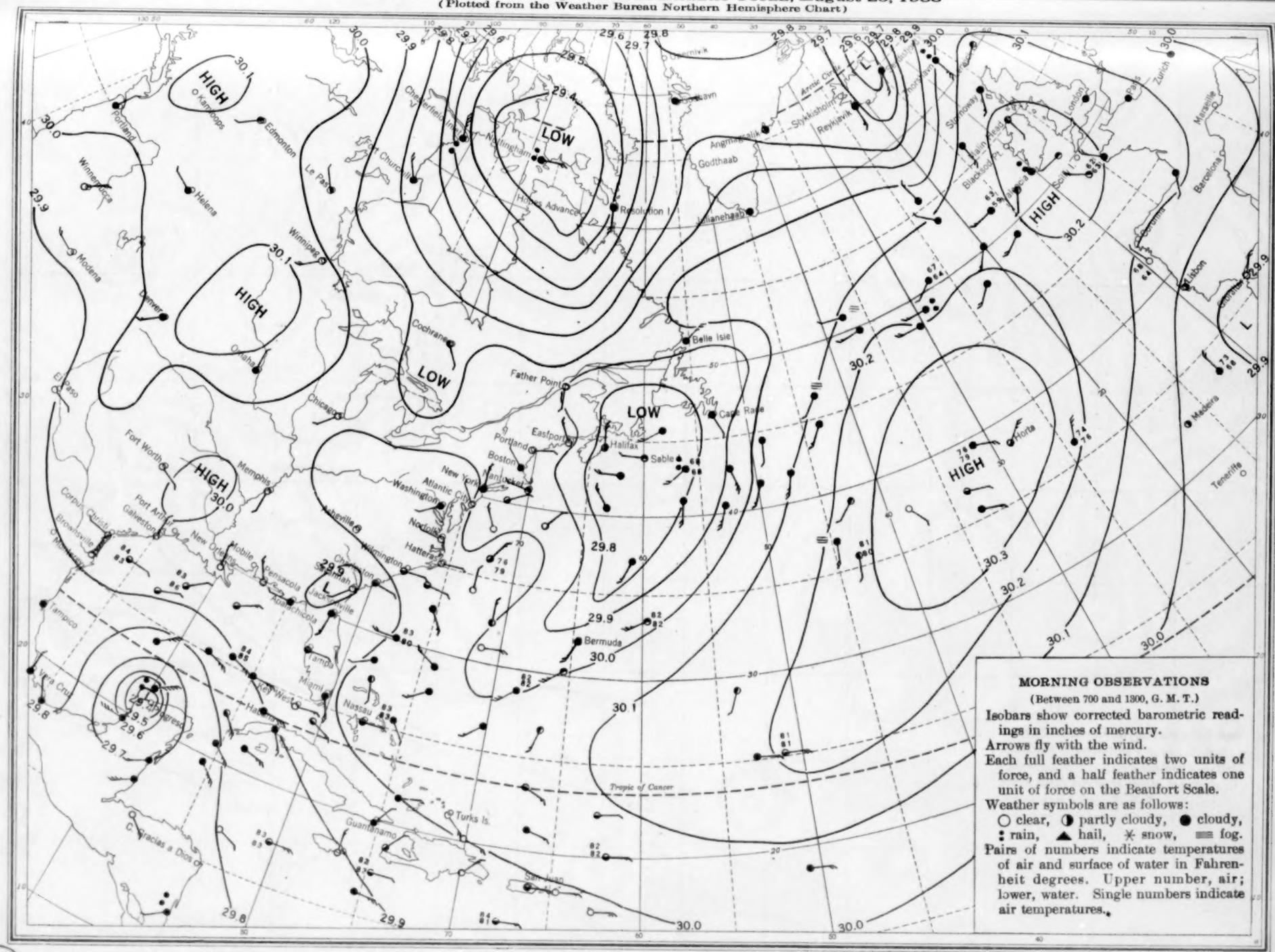

MORNING OBSERVATIONS
(Between 700 and 1300, G. M. T.)

Isobars show corrected barometric readings in inches of mercury.

Arrows fly with the wind.

Each full feather indicates two units of force, and a half feather indicates one unit of force on the Beaufort Scale.

Weather symbols are as follows:
○ clear, ◑ partly cloudy, ● cloudy, : rain, ▲ hail, ✳ snow, ≡ fog.

Pairs of numbers indicate temperatures of air and surface of water in Fahrenheit degrees. Upper number, air; lower, water. Single numbers indicate air temperatures.

Chart X. Tracks of Centers of Tropical Disturbances, August 1938

Chart X. Tracks of Centers of Tropical Disturbances, August 1938

(Plotted by J. H. Gallenne)